Light and Lighting

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Domestic Lighting

IT is open to doubt whether the improvement of artificial lighting in many factories and offices which has been effected in recent years has been paralleled in dwellings. Certainly, in many homes, the conditions of lighting leave much to be desired. Neither in living rooms nor in the domestic "workshop"—the kitchen—is there "sufficient and suitable" lighting in very many cases. Moreover, halls and staircases are often dangerously ill-lighted. A recent investigation in the Birmingham area has disclosed the startling fact that in recent years there have been more deaths from accidents in the home than on the roads. A high proportion of the accidents in homes results from falls and collisions with household objects, and bad lighting is recognised as one of the causes of these accidents. Good lighting in the home is one of the most desirable of domestic amenities, and it should be within the reach of most people in the modern "welfare State." What seems to be needed, however, before better lighting is likely to be established much more widely in our homes is a wider dissemination of knowledge of the principles of good lighting, and of the methods and equipment by which these principles can be put into practice.

Notes and News

Quantity and Quality

Study of Ministry of Education Bulletin No. 1* (New Primary Schools) has made us ponder on the meaning of the word *quality* when applied to lighting. It is usually used in close proximity to the word *quantity* to give us two words which trip nicely off the tongue like a name of a firm of contractors or a slogan for bigger and better lighting installations.

The I.E.S. Code itself in the very second paragraph tells us that "Lighting is good when it is suitable in quality and quantity for two purposes, namely, for creating general environmental brightness, agreeable and beneficial to the user, and for permitting a high degree of efficiency in seeing whatever is of special interest or importance." Later in the Code there is a section headed "Quality of Lighting" in which we are told that the suitability of a lighting installation depends on a number of conditions which affect what is "conveniently termed the quality of lighting." The Code then goes on to deal with the most important of these conditions, *including* values of illumination. We have a feeling that what is meant by *quality* is what used to be (and, in the Factory Act, still is) termed *suitability;* suitability for the particular job for which the lighting has been installed. If quality is a matter of diffusion, spectral composition, etc., then two exactly similar installations, one in a foundry and the other in a classroom will have the same "quality"—but it is doubtful if they would have the same suitability—which is what matters. (We only hope that in our confusion we have not introduced a third expression to make matters worse.)

However, to get back to the Ministry of Education; in the bulletin referred to reference is made to quality in the sections dealing with daylighting and artificial lighting and in both cases it would seem that the interpretation, from the point of view of lighting in primary schools, is that *light* which is of good *quality* is *light* which is *not flat*—the complaint is made that light provided by the common types of diffused fittings lacks an appropriate degree of sparkle and stimulation. Let us accept that as one of the points affecting the quality of lighting as far as schools are concerned; there are, however, lighting applications where this "good quality" might become a "bad quality." So where are we? It looks as if we are back to suitability again—and how can one think of suitable lighting without including, among other things, the level of illumination? It now looks as if we have reduced that nice phrase "quantity and ability."

Perhaps our readers would be good enough to tell us what they understand by "quality" by contributions to our correspondence columns. We are sure the discussion would be most useful.

* H.M.S.O. Price 1s.

Next I.E.S. Sessional Meeting in London

The next I.E.S. sessional meeting in London will be held at the Lighting Service Bureau, 2, Savoy-hill, W.C.2, at 6 p.m. on Tuesday, March 14.

At this meeting a paper entitled "Visual Aids for Landing in Bad Visibility, with particular reference to the Transition from Instrument to Visual Flight," will be read by Mr. E. S. Calvert, of the Royal Aircraft Establishment. The paper gives an account of the crossbar system of approach lighting and is of particular importance as this system may be adopted internationally.

The Ideal Home Exhibition

The twenty-seventh Ideal Home Exhibition, organised by the "Daily Mail" at Olympia from March 7 to April 1, is well worth a visit. For the most part the stands are tastefully arranged and well illuminated. One stand is effectively lighted by a dimmer-controlled tungsten installation but the majority have daylight fluorescent lighting. Many of the fluorescent tubes are fitted with the clip-on type of louvre which eliminates glare and the level of illumination provided is high.

In fact, it can be said that the standard of display lighting on the stands is greater than that of the actual lighting fittings exhibits. Ideal homes should have ideal lighting, but this is not in evidence at the exhibition. It seems that lighting fittings manufacturers have missed another excellent opportunity to bring their products to the notice of the public. One stand is, unfortunately, cluttered up with elaborate and beautiful chandeliers and wall brackets in crystal, venetian and coloured glass, carved wood, metal and wrought iron. For, even if these fittings are not exactly practical, they might have been the more effective had they been arranged in a less crowded way. There is a good display of double-ended tubular filament lamps and reflector fittings designed for lighting bedheads, mirrors, pictures, desks and architectural features. The fittings, modern in design and moderate in price, are very practical and should be of help in proving that good lighting need not be expensive.

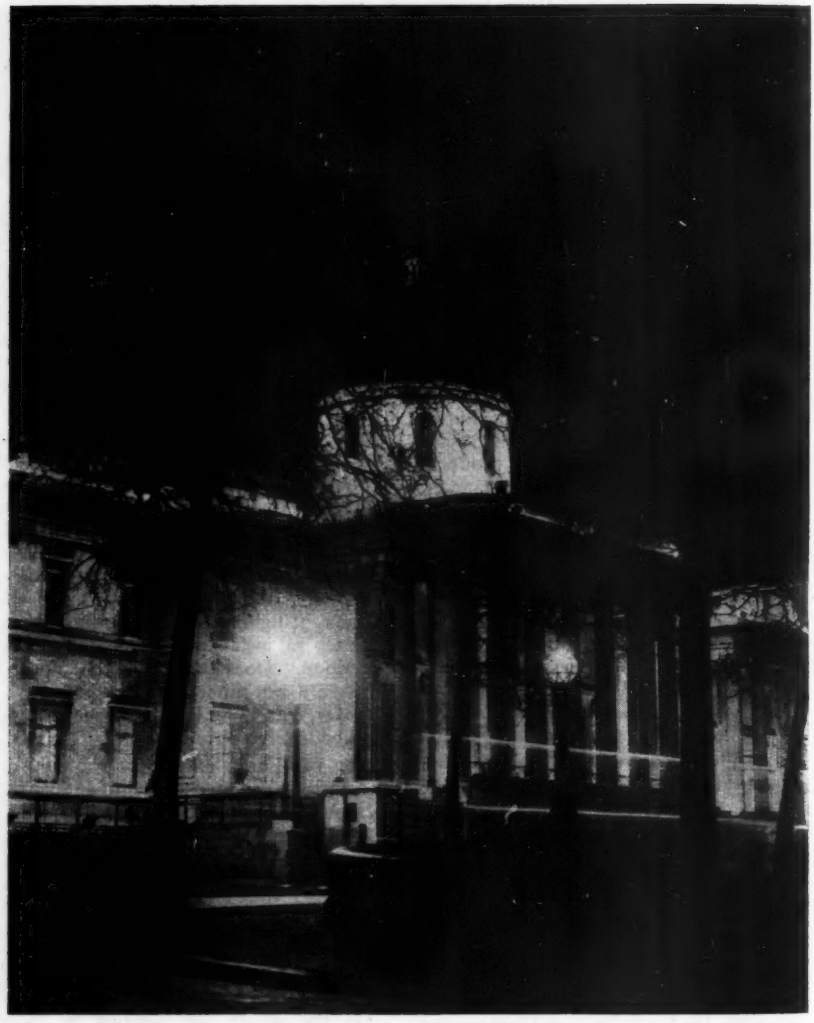
Perhaps the most interesting part of the exhibition is the village of ideal homes, comprised of five fully furnished houses. One house was brought over from New Zealand and is typical of the 4,000 houses built there every year by private enterprise for letting by the Government of the Dominion. The house is well designed, compact and all electric and designed for the housewives who have no domestic help. The rooms are airy and bright with broad windows to admit plenty of natural light. This is, perhaps, just as well, for the arrangements for artificial lighting are not so satisfactory. Single points have been provided in the centre of the ceilings from which dangle the most unimaginative fittings.

Lighting arrangements in the other houses vary from the bare necessities to, in one case, an excess of everything. As lighting engineers know only too well, economy is an important consideration in lighting design. It is generally agreed by those who have taken the trouble to give the matter some thought that the single lighting point from the centre of the ceiling is not the ideal way in which to light a room. At the same time, few people are likely to favour the provision in the lounge of the present day £2,000 house of two ceiling points and *seven* wall brackets as is the case in one of the houses shown. In the same house, the dining room contains one ceiling point and five wall brackets with the lighting in the bedrooms on a similar scale. In contrast, in the other houses, use is made only of the occasional table or standard lamp for local lighting. It seems that the happy medium has not been reached.

In only one house is use made of fluorescent lighting in the kitchen. There were several instances of this at last year's exhibition. Does this mean that housewives are not impressed? One house, however, has a flush fluorescent trough for lighting the porch.

The furnishing of one of the houses was designed by the Council of Industrial Design, the effect being much better than their exhibit at the 1949 show. The use of paper shades, mentioned in our report on the recent exhibition of European Lighting Fittings (February issue, p. 65) will be noted. The use of a reversible fitting fixed so low on the wall that in the inverted position one could see the bare lamp, is not very good.

On the whole, the lighting in these houses is rather more imaginative than in the majority of homes. It is to be hoped that many of the thousands of visitors to this well organised exhibition will profit from what they see and that at least they will learn something about lighting and its application in the home.



During the earlier part of this month many famous London buildings were floodlit in honour of the French President who was then visiting this country. Above is a view of the National Gallery.

Light in the Home

By CAROLINE HASLETT
D.B.E., Comp. I.E.E.

It has frequently been said that the application of light in the home is not so much a matter for the lighting engineer as for the lighting artist. However true this may be, it is usually the lady of the house who has the last word on the lighting. This article is written from the woman's point of view.

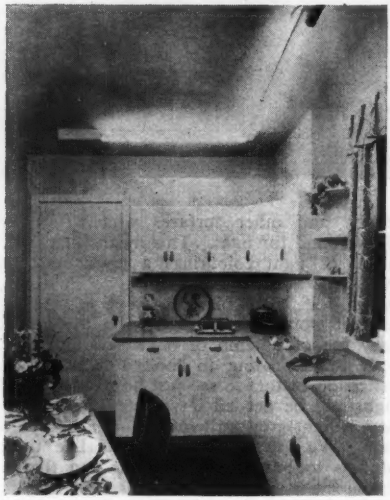
Most women to-day, faced with home furnishing and decoration, have one question to ask, "How much will it cost?" While it is impossible to economise in material in, say, re-upholstering a living-room suite, or buying a new carpet or new curtains, too many people try to cut down on their requirements in lighting, and they do not realise that such skimping often spoils the whole effect; in fact it is not economy at all.

Good lighting depends on having the right kind and quantity of light in the right place and in the right surroundings, but the busy housewife cannot be expected to know offhand exactly what she needs. She does know, however, that often her lighting seems drab and uninteresting while her neighbour's house may create a restful, welcome effect. She is even more puzzled when she realises that the total wattage is the same in the two otherwise identical houses. She will want to know how her neighbour has managed to provide useful and decorative lighting for the same amount of current that she herself has had to pay for.

Nobody can be extravagant these days both on account of the peak load problem and also because housewives must keep a wary eye on household budgeting, and it is therefore most necessary to spread lighting knowledge among the public.

In the past years we have all become used to new materials for every-day use such as plastics and nylon, and we have had to learn new techniques in handling them. Similarly we all need to become aware of the new possibilities which lighting holds for us in our homes, now that we have shaken off the black-out complex. Great progress has been made in street and architectural lighting, and there seems to be a public consciousness of both the safety and aesthetic value of light in public buildings and thoroughfares. It is certainly necessary for this lighting consciousness to permeate the ordinary home.

The close relationship of light and colour is one of the most important points to get across, whether the colour relates to the darkness of the shade or of the walls, ceiling



A good light in the right place makes work easier and safer. Here fluorescent lamps mounted on the ceiling and arranged parallel to the main kitchen equipment provide shadow-free working conditions.

and floor, or even to the dimness caused by dust which is often allowed to accumulate on lamps and fittings. It is surprising to find how great is the reflective effect of a light ceiling, especially where the light fitting is enclosed below and open at the top. The wattage of the lamp is intensified merely by throwing the light against a light surface. In fact it has been scientifically worked out that a white ceiling reflects more light than a pale cream one, and this in turn reflects more light than one of pale peach pink. The same is true of walls, floors, doors, and other surfaces which form a background for light. This means that with a set of light colourings a given wattage would be adequate, but if the colour tones were dull then perhaps twice as much current would be required from the necessary use of a lamp of higher wattage.

It is fascinating to look at a table of reflection factors to see just how much extra light will be needed if you decide to have, say, a light grey wall instead of a primrose one. We all know that artists like their studios to have a north light, and that a living-room facing north or east needs warm, bright colours, but we don't extend our knowledge throughout the house to realise that the same principle in light is applied all over to a greater or lesser degree. Nor do we appreciate that attention to such matters has a considerable effect on the family purse and on the family setting. Surfaces, too, have a special bearing on lighting effects, as a highly polished surface can cause "glare" because of its highly reflecting properties.

Good lighting creates a general air of well-being just as inadequate lighting suggests a rather drab existence, but, what is more, good lighting makes a positive contribution to health and safety, and it is this latter aspect which cannot be passed over by any household. Broadly speaking, lighting can be divided into light for essential use and light for decorative purposes, but most families will want to combine the two. The wide range of well-designed fittings and the greater number of socket outlets now provided in houses and flats mean that the requirements of utility and beauty can both be met in one lighting scheme.

There are two things to remember in providing light for essential purposes, and that is that good general lighting is necessary, as well as local lighting where special work is being carried out. Each room has to be treated on its own merits. Sometimes a central fitting, which is well designed to diffuse light over a wide area and against a light ceiling and walls may be sufficient. In another room where the window and furniture are differently placed, the centre light

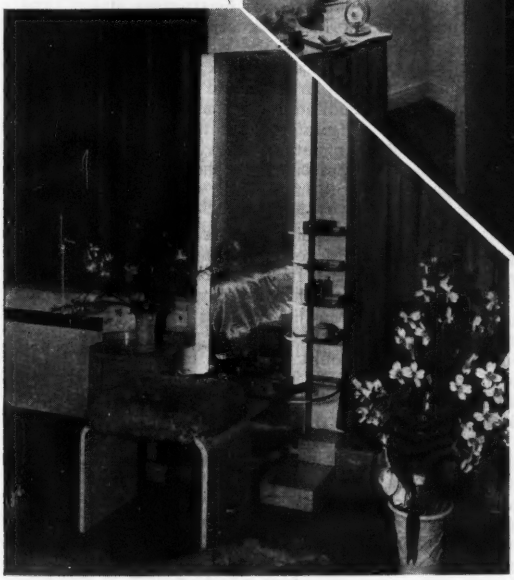
Two good lighting ideas turned this attic into a thoroughly useful and attractive study. Tubular lighting for the desk is concealed at the top of the window recess and similar lighting behind a narrow wooden pelmet gives a good illumination on the backs of books

will need to be reinforced by table lamps or floor standards or by bracket lighting on the walls. One of the pleasures of lighting for the housewife who understands something about the subject is that lighting is individual. She may find her furnishing materials repeated in someone else's house, but it depends on her own artistic ingenuity whether or not her lighting scheme is distinctive.

The woman who understands the scientific principles of lighting and has provided the best lighting for all essential purposes in her home can indeed be encouraged to have fun with decorative lighting. In fact, the amount of money it will cost will bear favourable comparison with other outlays on "extras" in the household budgeting. Gardening, for instance, can be a highly expensive hobby, but the more experienced one becomes, the better the results for a less amount spent. As with flower arrangement, there is no end to the effects to be obtained in the artistic use of light, and flower lighting itself is but one of many.

Some effects are only for special occa-

(Right) Lighting in larders, deep cupboards and built-in wardrobes is a very great asset both for convenience and tidiness. A low wattage lamp is adequate and an automatic door switch ensures against wastage of current.



(Left) The ideal illumination for making-up is obtained by two four-ft. fluorescent lamps behind strips of prismatic glass, thus directing the light inwards.

sions, but it is an individual triumph for a hostess to create a lighted flower masterpiece for a party. Other kinds of decorative lighting, such as picture lighting or the lighting of china or glass cabinets are permanent.

Beautiful effects can be obtained from "black" light used with special paint, but this is not within the reach of the ordinary woman seeking to beautify and individualise her home.

In providing light for the family, attention has to be given to each individual. Older people in general need more light than young folk, though study lamps are almost essential for the student of whatever age. A family living-room should, therefore, have good general lighting with individual lamps for those who are reading or sewing, and a special lamp for a child who has to do homework in the bosom of its family. It is far better in every way to give the boy or girl a well-lighted bedroom, and the lighting, if carefully planned, need not cost any more than the rather haphazard lighting usually found in bedrooms. If it is the intention to provide a real study, an interesting effect can be obtained by strip lighting at the top of the window over the desk or shining on to the backs of books in shelves. Even attic bedrooms with sloping walls can be made very attractive by a combination of colour and carefully placed lighting. As daylight is rather restricted and space is often cramped, artificial light can help to create a feeling of space.

Coming back to the general question of bedrooms, they are often provided with nondescript kind of lighting, and it rarely seems to be in the right place. We have surely gone a long way from one central fitting controlled by one switch from the door, but even when a special light is provided over the bed there is still the dressing table requiring attention, and the fact that this is often too inadequately lighted, is seen in the badly applied make-up of women and girls in the early morning tubes and buses. Moreover, we have all suffered from delving hopefully in the back or top of a clothes cupboard for articles which we cannot see. The installation of a light inside is not an expensive matter, and combined with an automatic door switch it greatly adds to our convenience without making inroads into our purses. Bathrooms, too, are other places which tend to be neglected in lighting schemes, but strip lighting over the mirror is always appreciated once it is installed. Strain of any kind is bad for health, and eyestrain is especially harmful, so that any small provision of light which will take away such strain has a beneficial effect on health.

Safety in the home demands that stairs, halls and passages should be well lighted and that cupboards and cellars should not be neglected. Here it is almost essential to provide two-way switches or even time switches. Again this necessary utility lighting can be made interesting with special lighting consuming little current, and the more ambitious housewife could light her stairs by strip lighting at ankle level all the way up. This is not as extravagant as it sounds, and the effect is most impressive as well as increasing safety.

The kitchen is the room where safety and efficiency in lighting is perhaps most necessary, for it is here that the housewife spends most of her time. Pleasure too is given by having lighting adequate for all one's jobs, as there is nothing more irritating than being in one's own light or having other people obscuring the light. Lighting and kitchen planning are inextricably linked, and each of the work centres should have sufficient light for the work carried out there; that is to say, the sink, cooker, preparation table, and larder should all be well lighted with the minimum of shadow—modern electric refrigerators have their own internal lighting. An automatic switch for the larder will be appreciated by the busy housewife who has both hands full.

The housewife will no doubt say that the foregoing is all very well, and that she would like to be personally acquainted with all these facts, especially as they relate to her own home. She has not time to take specialist courses on home lighting, but would welcome some instruction which would assist her in reassessing the lighting needs of her own home. She should be encouraged to realise that the Electricity Service Centres and the electrical contractors of repute are only too willing to place their knowledge at her disposal, not to sell her a lighting fitting as a solitary unit, but to help her to decide what will best harmonise with her colour schemes and meet her family's needs. There is a fascinating career for the woman home lighting specialist, one which was beginning to make headway before the war dimmed all our lights. Now that they are one by one coming back enhanced with the new techniques discovered during the war there are fresh possibilities for women as designers of fittings or as advisers to an increasingly light-conscious public.

Towards Better Home Lighting

By J. N. ALDINGTON*
B.Sc., Ph.D., F.I.E.S.

The latest lighting developments should be applied to the home just as much as to other places. The idea of lighting rooms by means of a single centrally suspended fitting is a thing of the past and the basis for the provision of lighting facilities in new homes should be reconsidered.

In my presidential address to the Society, when referring to the subject of lighting in the home, I declared: "It is surely just as important that the homes of the people should be effectively served by our Society as it is important that our great public buildings and factories should have properly designed lighting installations," and I take pleasure in expanding that theme in the present article.

We have to consider home lighting from two different aspects, which are, however, complementary—the utilitarian and the aesthetic—in the home each aspect is incomplete without the other, and in a good lighting scheme both should have a place, although in general it is the utilitarian aspect which is of the first importance.

On the planning side I believe that the same care which is exercised in the prescription of minimum standards for room areas, ceiling heights, effective precautions against access of damp, adequate drainage and many other requisites should be extended to include minimum standards and specifications for basic lighting in the home. In this respect I would differentiate between basic lighting and supplementary or effect lighting.

The present practice is to provide in the majority of homes a single lighting point in each room with an additional point in certain rooms of the better class houses.

The important point to realise in this connection is that it is not generally possible to provide adequate lighting for all purposes from a single point in a room having in mind the variety of working tasks which must be carried out by the occupants of the house.

The choice of lamp and fittings is frequently left to the householder, who may have little or no knowledge of the basic requirements which govern the selection of these all-important items of equipment. The occupier of a newly built house may therefore find himself with a lamp-holder dangling from a cord perhaps a foot or so in length emanating from a ceiling fixture which itself is only about eight feet from the ground. Quite often a clear gas-filled lamp is fitted and the light source with a brightness of perhaps 2,000 stilb will then be suspended only 7 ft. or so from the ground and within the direct vision of some at least of the room's occupants. This state of affairs is then counteracted in many cases by the addition of an ornamental shade which, while providing a pool of light of reasonable intensity over a limited area beneath it, condemns the occupants of the room outside the immediate area to entirely inadequate levels of illumination.

In all this I want to stress that I am directing my remarks to the common conditions which I have observed in many properties, both old and new. It is true, of course, that there have been major advances in the last two or three decades in regard to the question of home lighting. The candle and the oil-lamp have practically disappeared as standard means of illumination, except in remote farmhouses and country districts.

In these days of electric illumination advantage has been taken of new lighting techniques and lighting fittings specially designed for use in the home, but it is still a matter for grave concern that these advantages have not been made available in the general way which is now suggested, nor is the necessary knowledge apparently available in suitable form to the multitude of small contractors responsible for wiring the houses at present being built.

It is suggested, therefore, that the following steps should be taken to make available

* President of the Illuminating Engineering Society.

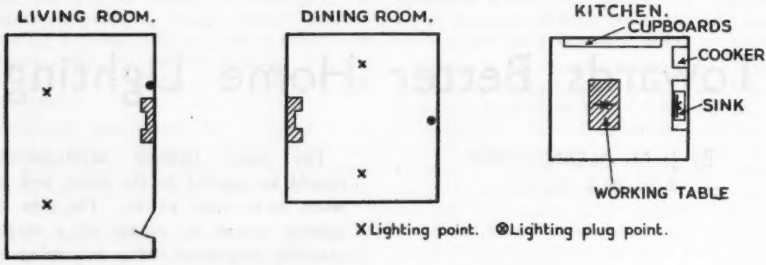


Fig. 1. Suggested positions for basic lighting points.

to the people generally the advances which have been made in illuminating techniques in the last few decades. First of all, with regard to the position and number of light sources, reference should be made to Figure 1, which shows basic plans for the most important individual rooms in a house. These plans are explained in the schedule below:—

Living Room

Basic Lighting.

For the average room in modern properties of, say, 12 ft. × 14 ft., two points should be provided close to the ceiling and in the ceiling area remote from the fireplace, and each position should be fitted with a source of at least 2,000 lumens. (See plan.)

Supplementary Lighting.

At least one 2-amp lighting plug-point should be provided in the fireplace recess, remote from the room door. (See plan.)

Dining Room.

Basic Lighting.

In most small family houses this room is also used as a study by the children and as a workroom by the mother. Two lighting points should be provided, situated on a line bisecting the ceiling and near to the room walls. (See plan.) Here, again, at least 2,000 lumens should be provided from each lamp for every 75 sq. ft. of ground area.

Supplementary Lighting.

One 2-amp lighting plug to be provided at the back of the room, to enable a study or equivalent table-lamp to be conveniently used on the working table.

Kitchen.

Here the main requirements are for adequate light on the working table, the kitchen sink, cooker-top, and on the vertical planes occupied by the cooker-oven and any wall-cupboards. At least two lighting points are essential, and the fluorescent lamp is ideal for this purpose. One lamp should be mounted over the sink and another at right angles to this first lamp in such a position as to illuminate the work table and cupboard faces.

Stairway Lighting.

Basic Lighting.

Great attention should be paid to this matter. Accidents happen from time to time in the home, due to inadequate or incorrect stairway lighting. The lighting should be arranged to sharply differentiate the treads from the risers. In general, for this purpose a fairly directional source is required and its position in relation to the staircase needs careful consideration. It is generally sound practice to place the light source or sources so that the risers are in shadow and the treads are well illuminated.

Bedrooms.

Basic Lighting.

From a functional point of view the lighting in a bedroom should provide satisfactory seeing conditions with respect to dressing-table and robing-mirrors and for reading in bed. At the same time it is desirable that the general illumination emanates from light sources which are out of the line of vision when the room occupant is lying in bed. If this is not possible, then the brightness and brightness contrast of the lighting fitting must be kept to a low level in relation to the surround brightness. To achieve these desirable results, therefore, the general illumination may well be achieved by an arrangement which lights up the wall surface immediately behind the bed-head as distinct from the more general method of illuminating the ceiling.

With regard to mirror lighting, it is necessary to appreciate that the light source must be so placed as to illuminate the face and figure of the observer and not the mirror. The illuminant must therefore be in the same plane as the mirror or somewhat behind it. With this arrangment the light source will therefore be visible to the observer and must be arranged to have a low surface brightness, preferably by being placed behind a sheet of diffusing material or in a large low-brightness fitting. Here, again, the fluorescent lamp is a suitable primary source, but for the above purpose it must be operated behind diffusing material to reduce the brightness to an acceptable level.

The above remarks apply, of course, also to the illumination of bathroom mirrors, where existing arrangements often leave much to be desired.

Lighting for Special Effects

The lighting arrangements so far suggested have as their basis the strictly functional requirement of providing effective and strain-free vision in the home. The value of utilising the beautifying effects of lighting should not be overlooked, however, when conditions allow of the installation of special additional features. The fluorescent lamp, with its wide variety of colour possibilities and its comparatively large area of low brightness, is particularly suitable for such uses. Some examples are given below.

Illumination of Wall Surfaces

In the homes of this country the general method has been to arrange the light source

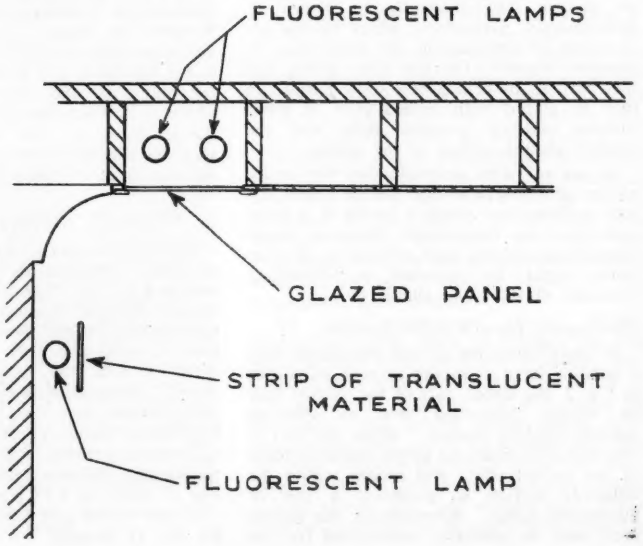


Fig. 2. Alternative arrangements for wall surface lighting.

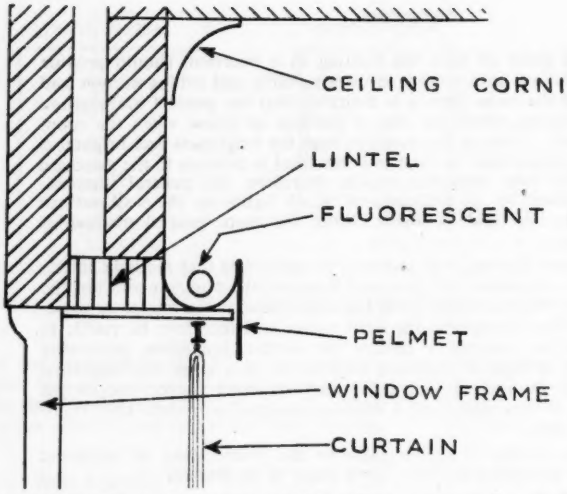


Fig. 3. Pelmet lighting fitting

approximately at the centre of the ceiling surface and to allow the natural distribution of the source to light up the ceiling areas and adjacent walls. A more pleasing and often more effective and restful result can be obtained by arranging to illuminate one or more of the vertical wall surfaces. For this purpose a fluorescent lamp or line of fluorescent lamps can be mounted behind a strip of opaque or transluscent material, as shown diagramatically in Figure 2. Alternatively, particularly where houses are in course of construction, the lamps may be mounted between the first floor joists, and that part of the ceiling below the lamps can then be glazed with reeded glass or other suitable material mounted flush with the finished plaster surface of the ceiling.

In general it is desirable that the centre of the light source should not be nearer the wall surface than about 6 inches if a large area is to be illuminated, otherwise small irregularities in the wall surface or decorations might be revealed as disturbing contrasts of light and shade.

Illumination from Window Pelmets

In cases where the cornice mouldings over a window have a smooth section, as shown in Fig. 3, the upper part of the pelmet may be readily converted into an effective indirect lighting feature. Often all that is required is to paint the upper inside surfaces of the pelmet white and mount within the reflecting surface so produced a line of fluorescent lamps. Alternatively the pelmet itself may be specially constructed for the purpose, in which case the section shown in Fig. 3 has proved very convenient and efficient. Such a pelmet is readily fabricated from thin sheet aluminium.

Conclusion

While many of the suggestions which have been made are designed to have a beautifying effect in the home, it is the author's opinion that the bias should always be towards the functional aspects of lighting. Nowhere is there a greater need for the provision of improved seeing conditions than in the homes of this country and, indeed, in the homes of the common people everywhere. The Illuminating Engineering Society should keep in the forefront of their activities this important matter of improving the standards of home lighting.

Physical Society Exhibition

The thirty-fourth annual exhibition of scientific instruments and apparatus arranged by the Physical Society opens on March 31 at Imperial College, South Kensington. It will be open to the public from 2 p.m. and will remain open until April 5 with the exception of Sunday, April 2. Admission is free and is by ticket only, which may be obtained from the Exhibition Secretary, The Physical Society. 1, Lowther-gardens, S.W.7. As usual the programme includes a number of discourses, one of which, at 6.15 p.m. on April 3, is on "Colour Vision and Colour Television," by Dr. W. D. Wright.

Home Lighting

Flowers and Light

Amputating living things and taking pleasure in watching them die is undoubtedly a pretty gruesome business and to the stolid lighting engineer most flowers in most vases mean very little more than that, and, indeed, to give these gentlemen their due, even with someone who likes cut flowers the subject flourishes best on a rather ephemeral plane.

Therefore, before discussing light and flowers let it be taken for granted, let, in fact, our data be that flowers anywhere and everywhere are pleasant and that most people like them.

Having assumed that, we can start to think about them without apologies and treat them in the same way as any other work of art for, while nature has a happy way of growing them so that they look just right, when we take them out of their natural setting we need all the artistry at our command to achieve anything like the same results. There is, although it is probably not kind to stress it, all the difference in the world between flowers arranged by the unskilled and flowers arranged by the man or woman who knows, and before scoffing at this let it be remembered, where the cost of flowers is of importance, that those who know make far fewer go much further.

This leaf composition is lighted by lamps from above.

An attractive flower arrangement backed by a silver-grey curtain which is lit by fluorescent and filament lamps.

"All fresh this morning, lidy. Ninepence a dozen" is one of the biggest snares in successful flower decoration and is largely to blame for the majority of the unedifying bunches that so unhappily rear their disillusioned heads on dining-table and mantelshelf in the very inartistic homes of this complacent little country.

An even number of exactly similar flowers is terribly hard to arrange and the wise person will, wherever possible, buy three of this and five of that and seven of the other, odd numbers you will notice in each case, and having bought them, have no compunction about collecting twigs and leaves at random, for while there may be a great deal of man-made snobbery about mixing things that cost money with things that cost nothing at all such social barriers

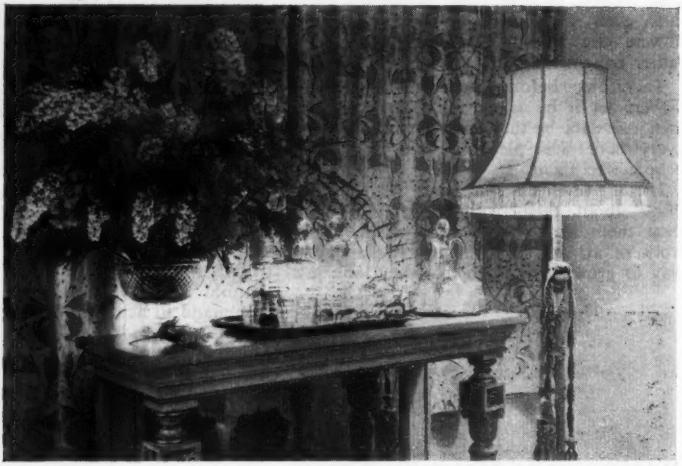
do not exist among things that grow; in fact they really do enjoy a mixed community.

Armed with such a variegated collection and a few florists' wires it should not be difficult, if you have a glimmering of what you are about, to work out a composition that has light and space and form.

A very good training for the eye of anyone who has the spark is to be found in studying the flower-paintings, the genuine flower-pieces, and not the "herring-and-bunch-of-daffs" still-lifes, in our great picture galleries. If you live in Wales this is not a directive to visit Swansea for Brangwyn was as Brangwyn did, and if you try to emulate that gentleman you are almost certain to go mad or at least be imlook they are probably held in place by no end of strange devices.

To realise this is a large part of the battle won. Use crumpled wire-netting as a base, it is better than your classy glass holders, and if it is inclined to slip about stick it down with plasticine. Then if the flowers will not bend on their own in the way that you require, twist wires around their stems, or in the case of fleshy stalks like those of daffodils and tulips, run a wire right up the centre. And when, at last, you come to the arrangement do not overcrowd. Each flower or leaf is usually a lovely shape in itself and if you crush everything together nothing can be appreciated.

So much for the flower arrangement, now



An unusual effect is obtained by mounting a fluorescent lamp behind the edge of a side table.

pounded for major thefts at Kew. No, take the more orthodox flower-pieces and observe them, and rarely will you find a painting of the "ninepence a dozen" type of bunch but rather that the painter has, in almost every case, composed a design in three-dimensional form, as well as colour, before he has got down to work. All the lush aristocrats of extreme cultivation are there, but you will see, if you look, that they are more than likely mixed with hedgerow briars or meadow grasses and that some sophisticated vine may well turn out to be a most uncultivated convolvulus or even simple ragged robin. Neither do all the flowers stand up; they bend, they curl, they follow the curves of the vase or boldly strike across them. They all seem wonderfully effortless and casual, but remember that however casual they may

for a few methods of lighting. These divide themselves roughly into two sections. In the first the emphasis is on the flowers and in the second on the background.

The most normal way of lighting flowers is to have some form of illuminated base for them to stand on. This may be portable and consist of a pedestal or box topped with opal glass below which the lamps are installed, or a luminous panel built-in to shelves or furniture, the centre of the dining table, for example. Either way this base lighting has great charm, but where it is used it is essential to have flower arrangements which really do take up the light. For instance, it is quite hopeless to place a tall solid vase with lofty flowers on a small panel and expect more than the vase to be lit, the best thing would be a low glass bowl with flowers that hang low and are within

easy range of the diffuse glow one gets from this kind of light source.

Other methods of lighting the flowers themselves are to have them spot-lit in some way or to have special containers ringed around inside with curved architectural lamps. Of course, if the containers are not curved any sort of tubular lamp will do, and in this dummy bowl the real flower container can stand. The good old-fashioned jardinière looks wonderful like this, but for the most part such pieces are rather too bulky for the home, although they are excellent for the more commercial displays.

The background treatments may either make use of flat lighting to throw up silhouettes or make the most of shadows thrown by the flowers themselves. Both are satisfactory if properly used and both lend themselves very well to colour. The blended light from two or three coloured lamps can merge delightfully on a pale wall or on curtains behind flowers, and the same effect can be obtained by wrapping coloured gelatines around fluorescent lamps. One of these mounted just below the top at the back of a sideboard or console table will not only give splendidly theatrical effects to flowers but to any form of glass as well. Shadows can be coloured by making certain that those from one light source at least are really dense and then lighting them from the sides with different colours. Two or more point sources of coloured light are best, but they are sometimes rather difficult to arrange. Projector lamps produce the best results, but because fairly high wattages are usually required, and these generate rather a lot of heat they are not very easy to house. Incidentally, with all flower lighting care should be taken to see that the bottom of the feature does not get too hot, for otherwise good furniture may get damaged.

Writing of heat, the most general query when discussing light and flowers is about the effect the heat of the lamps has on the life of the flowers. The answer lies in using just a little common sense. Boiled greens are boiled greens anywhere, and if filament lamps are placed so close to the bowl or vase that they make the water hot or cause upward draughts of hot air then, of course, the flowers will die, but a small amount of warmth hardly affects them at all. Naturally, the cooler the light the better, and for this reason fluorescent lamps are particularly suitable, but let us not allow this to raise the question of colour-rendering, for this is solved by common sense, too. Flowers react to different colours like anything else, and the individual must either select flowers to suit the lighting or lighting to suit the flowers. Florists certainly like daylight or natural fluorescent and lots of it, but it doesn't necessarily follow that either is right in your room.

Table decorations are illuminated by a lighted panel in the dining table. No trailing flex is needed for there is a flush floor plug beneath the table.

There is nothing extraordinary about lighting flowers, and indeed there is no good utilitarian reason for doing so, but if you like flowers, if you think they are decorative and if they give you pleasure about the house, then you have a great deal more pleasure in store if you have not yet tried lighting them. But do remember that you are dealing with artificiality *in excelsis*, and that the best effects are, unfortunately, only achieved with thought and care and a real feeling for the subject.

I.E.S. Annual General Meeting

The annual general meeting of the Illuminating Engineering Society will be held at the Playhouse Theatre, Buxton, at 2.30 p.m. on Thursday, May 18, 1950, when the report of the Council and the accounts for the past year will be submitted and the usual resolution will be moved appointing auditors for the forthcoming year.

Swedish Research on Daylight

The report summarised below is one of the most thorough studies of daylight conditions in rooms ever undertaken. The report is an account of recent work by Gunnar Pleijel, the Swedish architect, who has made valuable contributions to our knowledge of daylighting.

A very useful report has recently been published by the Swedish State Committee for Building Research. It is an account of an extensive investigation into daylight conditions by Mr. Gunnar Pleijel, the architect whom participants in the I.C.I. meetings in Paris in 1948 will remember as a very active member of the Swedish delegation and an indefatigable photographer. The work was carried out at the Royal Institute of Technology in Stockholm and the report, which costs 3 Swedish crowns, occupies some 67 quarto pages.

The author first gives a general description of the basic principles of daylight research by means of scale models and, as a preliminary to this, he defines the terms used. The definitions of daylight factor and sky factor are those now generally accepted. The sky factor is the ratio of the internal to the external illumination under the hemisphere of uniform sky, all reflected light being neglected, so that the ratio is solely dependent on the design and can be calculated from the geometry of the building. The daylight factor, on the other hand, is the ratio of the internal to the external illumination when reflected light is included. Mr.

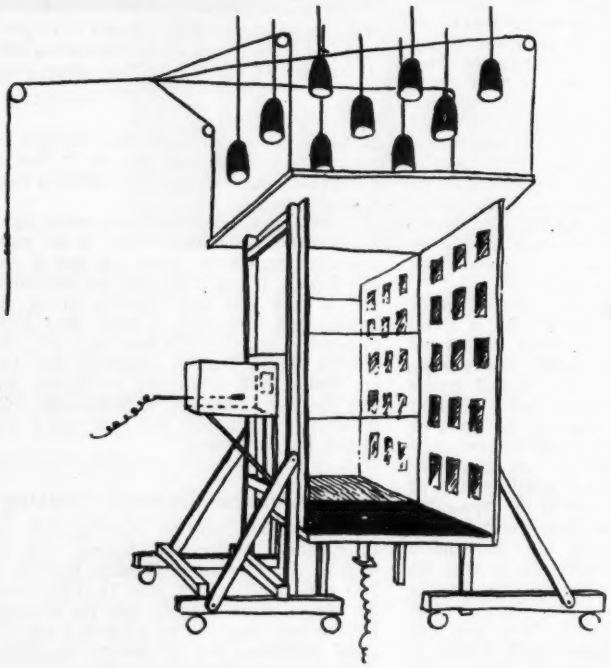


Fig. 1. Sketch of test set-up.

Pleijel also defines "direct daylight factor" as the daylight factor when all reflecting surfaces are completely black, the "reflected daylight factor" being the difference between the daylight factor and the direct daylight factor.

The object of the investigation was to determine how the daylight factor and the direct daylight factor at any point in a room

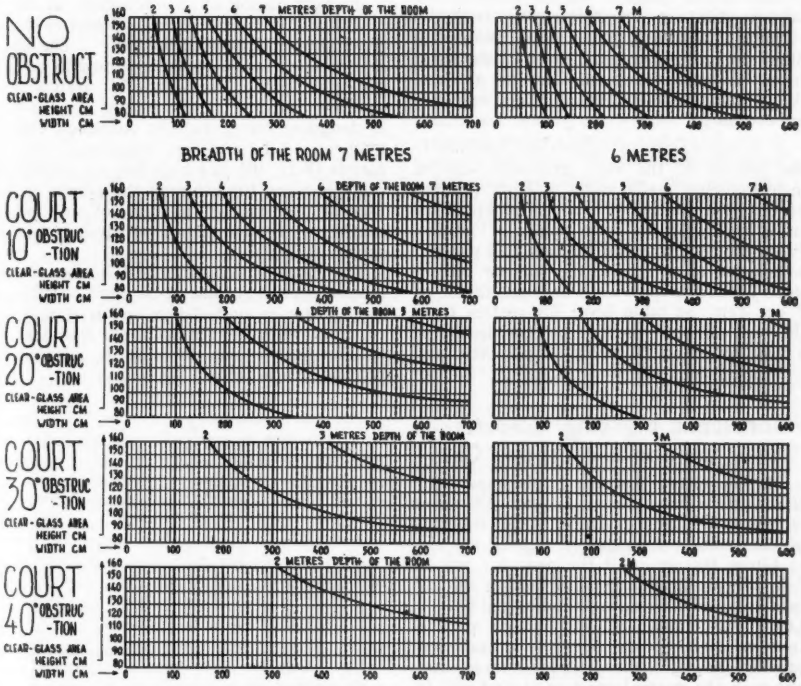

NO OBSTRUCT
COURT 10° OBSTRUC-TION
COURT 20° OBSTRUC-TION
COURT 30° OBSTRUC-TION
COURT 40° OBSTRUC-TION
CLEAR-GLASS AREA HEIGHT CM WIDTH CM
BREADTH OF THE ROOM 7 METRES
6 METRES
DEPTH OF THE ROOM 7 METRES
DEPTH OF THE ROOM 5 METRES
3 METRES DEPTH OF THE ROOM
2 METRES DEPTH OF THE ROOM

Fig. 2. Typical section of the graphs given in the report. This section includes diagrams for determining window size under common sidelight conditions for schools, offices, factories, etc.

were affected by the dimensions of the room and of the windows, and by the heights and distances of neighbouring buildings, by the colour of the house-fronts and by the colour of the internal decoration of the room.

The experimental arrangement used is shown in the sketch (Fig. 1). The array of lamps in shades at the top illuminated a sheet of flashed opal glass depolished on the under side. This provided an artificial sky of sufficiently uniform brightness. The small box shown on the left represented, to a scale of 1 : 13.5, a room 4 x 6 x 2.7 metres and its window faced a model house-front with window openings. The window of the model was glazed with ordinary window glass, the thickness of which was full scale since the laws governing dimensions in model tests are not applicable to transmissions or reflections, which are dimensionless. The colours of the walls of the room could be varied at will and the same applied to the house-front and the street surfaces. Mirrors were used at both ends of the model (one only is shown in the sketch) to produce the effect of an endless street. To investigate the effect of a court, or well, the ends were closed with model house-fronts like that facing the window of the model room.

The illumination at various points inside the model was measured by means of a photo-voltaic cell, 25 mm. in diameter, mounted in a special holder so designed that

the cell was corrected for errors due to obliquity of the incident light. The cell was connected in circuit with another of similar type which was illuminated by a lamp in a housing with a window of variable size. The two cells were in opposition and the illumination on the second cell was adjusted until the photo-currents were balanced. Previous calibration gave the illumination on the cell in the model. By this method, the fatigue effect in the cells was practically eliminated and, further, since the lamp illuminating the second cell was on the same supply as the lamps illuminating the artificial sky, fluctuations of supply voltage were unimportant.

It is impossible to summarise adequately the results of the very extensive sets of measurements made under a large number of different conditions but the practical results are given in four pages of graphs. From the 54 graphs on the first two pages it is possible to determine the window dimensions needed to provide a daylight factor of 1 per cent. at table level 0.5 metres from the wall remote from the window, assuming a wall reflection factor of 58 per cent. and a house-front reflection factor of 20 per cent. The different graphs refer to rooms of different breadths with different conditions of external obstruction, outlook on a court of stated size or outlook on a street of stated width, and the curves on each graph refer to different room depths. These two pages are for use in the design of schools, offices, factories and the kitchens of dwellings.

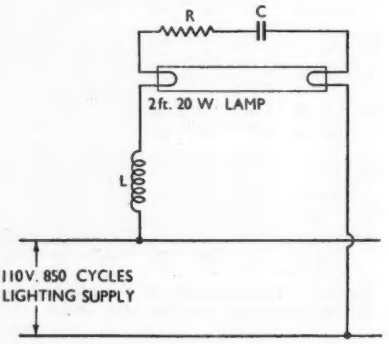
The other two pages contain graphs for determining the window size needed to give a daylight factor of 2.5 per cent. at table height and at a distance of 1.5 metres from the inside of the window wall. The conditions as to reflection are assumed to be the same as before and the 54 graphs are similarly set out. These graphs are for use in designing for daylight in dwellings, except kitchens. All rooms are assumed to be 2.7 metres (8 ft. 10½ in.) high but an alignment chart is given for enabling the graphs to be used in the case of a room of any other height. A typical section of these graphs is shown in Fig. 2.

The investigation described is one of the most thorough studies of daylight conditions in rooms ever undertaken and it should be of great value to the architect who wishes to ensure that his building is adequately provided with natural lighting.

Fluorescent Lighting Circuits in new London Transport Cars

The fluorescent lighting in the new "R" class surface line stock of London Transport represents the most extensive use of this type of illumination yet made in railway vehicles in Great Britain. All the gear for the 24 2-ft. 20-watt lamp circuits in each of the 225 cars involved is being supplied by the G.E.C., Ltd. The lamps are operated in parallel from a 110-v. 850-cycle supply of sufficient capacity to light the lamps in three cars, although the normal practice at first will be to supply two cars from each 110-v. output.

Power factor correction for the lighting circuits serving two or three cars is provided centrally so that the gear in the individual lamp circuits is confined to a series choke, a starting capacitor and a starting resistance. In addition to avoiding risk of interaction with A.C. track circuits of the signalling system, the relatively high frequency of 850 cycles enables a resonant starting circuit to be used for the lamps, as shown in the diagram. The choke L and capacitor C together form a circuit with a resonant frequency sufficiently close to that of the supply to give a voltage across C under starting conditions higher than that of the input; and a value sufficient to start the discharge in the lamp is obtained. Resistance R limits the voltage developed across the lamp to prevent the discharge striking before the filaments are adequately preheated.



Resonant starting circuit.

When the lamp strikes, the discharge virtually short-circuits C, so that the lamp receives the normal running voltage and the choke serves to limit the lamp current in the usual manner.

Rare-gas Lamps— The Gas Arc

By H. W. CUMMING,
B.Sc., A.R.I.C.*

After a section dealing briefly with certain characteristics of arc discharges in neon, argon, krypton, and xenon, the properties and main applications of the xenon filled Gas Arc are summarised. Experimental lamps based on the Gas Arc are described which "strike" on normal mains voltages, and which are of air-cooled form. The luminous efficiency and the brightness of the arcs are indicated; the brightness is shown to be similar to high-pressure mercury arcs under equivalent conditions.

1. Introduction

The neon floodlighting lamp, type NE/H, may be used to provide a convenient and simple demonstration of certain well-known and basic phenomena associated with gaseous discharge. If a current of a few milliamperes is passed through such a lamp from a high voltage transformer, the characteristic neon colour is excited and the lamp functions very much as a high voltage low current glow device. When, however, the filamentary electrodes are brought to incandescence, and a current of some one to two amperes is allowed to flow through the tube from the mains supply, a considerable increase in the emission from the gas takes place, and the luminous efficiency rises to some 12 to 15 lm./w.; the radiation, however, continues to have the characteristic line spectrum of neon. Further increase in the current becomes limited, due to restrictions imposed by the glass envelope, by the electrodes, and by the need for a usefully long life. A similar lamp designed with an argon filling gives the pale-blue radiation associated with the normal excitation of this gas; the luminous efficiency is however less than 10 lm./w.

This was the position about 1935, when it would appear that little development could be expected in the neon floodlighting lamp or in any similar light source using other gaseous elements or compounds; it is still the position to-day.

During the war years certain experimental work was carried out in which glass and quartz discharge tubes containing a low pressure of gas were subjected to the passage of very heavy currents—thousands of amperes—lasting however for periods of extremely short duration. From these discharges in the gas krypton luminous efficiencies of the order of 30 lm./w. were obtained, and, later, with the even rarer gas xenon 40 lm./w. The colour of the light, moreover, was not in accord with the characteristic spectrum of krypton or xenon, but in addition to the usual line spectrum there appeared a continuum of emission of sufficient intensity to appreciably and beneficially modify the colour and colour-rendering properties of the radiation. These flash discharge tubes and the means by which they are operated from a charged capacitor have been fully described. ([1,2].)

The gases krypton and xenon having a high molecular weight and low mobility tend to give a constricted arc, rather than the diffuse one associated with, say, argon or neon, and even in a wide arc chamber at comparatively low pressures give a thin, sinuous discharge. If, for example, two identical tubes contain equal pressures of xenon and argon, the current density of, say, a 10-amp. discharge through the xenon will exceed that of an equal discharge through the argon tube.

The high luminous efficiency and the quality of the radiation emitted in the flash discharge are caused mainly by the heavy current which, in turn, leads to an extremely high current density. It was believed that if the current density in an arc operating continuously could be raised to an order similar to that of the flash, then radiation of the same type would be emitted continuously. The Gas Arc was the culmination of an attempt to produce in a lamp, which could be operated continuously, an arc discharge through the xenon of such value as to achieve the conditions of excitation associated with the usefully high luminous

* Siemens Electric Lamp and Supplies, Ltd.

efficiency and radiation similar to that of the flash. ([3,4].)

2. The Gas Arc

In 1947 the development of a water-cooled Gas Arc of 5,000 watts rating was announced.

2. (a) *Constructional Details*

The lamp is designed to operate with a current density of high order and to have an envelope which closely contains and restricts the arc. It is prepared from a length of quartz tubing of about 13 mm. bore, containing two pointed tungsten electrodes of 12 mm. diameter separated by gap of 65 mm. The tubing is closed immediately behind each electrode by seals of molybdenum/quartz, to which electrical connection is made. The overall length of the lamp is 250 mm. The whole is designed to operate within a glass jacket through which a rapidly flowing water stream is circulated. Two designs of lamp are needed for operation on alternating and direct currents respectively.

2. (b) *Electrical Characteristics*

The 5,000-watt Gas Arc develops an arc voltage of 65 when passing a current of 85 amperes; the current density in the arc is of the order of 100 amps./sq. cm. Operation may be from either 200/250 v. 50 cycle A.C. or 100/250 v. D.C. supply in series with a suitable choke or resistance unit. The lamp striking voltage is high and initiation of the arc is brought about by employing a high-voltage Strayfield transformer; an arc is produced between the lamp electrodes by the transformer, and the mains voltage is then applied; current which passes is limited by the main series choke or resistance and the transformer is disconnected.

By adjustment of the series current limitting device the lamp may be operated over a considerable wattage range; the arc is stable from 1 to 5 kw., corresponding with a current of about 20 to 85 amperes. Moreover, the arc voltage is found to be directly proportional to the current over this same range.

2. (c) *Luminous Characteristics.*

The radiation from the Gas Arc approaches very closely that from the flash discharge. The spectrum consists of a complexity of lines covering the whole of the visible region and beyond; in addition to these lines there is present a continuum of radiation of appreciable intensity. Due to the large number of lines in the spectrum of xenon and their not uneven distribution over the visible region and due to the presence of the continuum the appearance and the colour-rendering properties of the light from the Gas Arc are similar to sunlight. A more exact match is found to occur with sunlight plus skylight to give a colour temperature of 6,000 deg. K; consequently the Gas Arc is faintly blue when compared with sunlight alone ([5]). A most important characteristic of this light source is that over the wattage loading of 1 to 5 kw. the colour of the radiation remains unchanged.

When operated at its rated wattage of 5 kw., the luminous efficiency of the Gas Arc is about 30 lumens per watt; the efficiency falls with decreased loading and at 20 amperes, which corresponds with some 1 kw., it is about 10 lumens per watt. Thus for the standard 5-kw. A.C. or D.C. lamp, bearing in mind the fact that operation may be between the limits of 1 and 5 kw., it follows that the light output may be varied by a factor of more than 12:1.

It should be noted that the gas arc emits light of a sunlight quality at an efficiency of 30 lumens per watt; these two facts should not be considered separately. A filament lamp may be made the source of an approximately artificial daylight by the use of a blue filter, but the overall efficiency of such an arrangement would be less than 5 lumens per watt.

3. *Applications of the 5-kw. Water-Cooled Gas Arc.*

The main applications for the Gas Arc are the floodlighting of objects to be photographed in colour and uses where accurate colour rendering to sunlight and daylight are essential. The appearance and the physical make-up of the light being similar to those of natural sunlight enables natural lighting to be supplemented or simulated without upsetting the colour balance of objects both to the eye and, what is perhaps more important, to the photographic emulsion. The high-intensity carbon arc is the only alternative light source which may be used directly in a similar capacity.

The gas arc has been used with the Technicolor process and either separately or in conjunction with carbon arcs has been shown to be suitable. Little or no difference is experienced by camera-men and other technicians because of the close similarity of the colour of the light from the Gas Arc and carbon arc; consequently, no visual distortion is set up as with other discharge lamps designed for use in motion picture studios.

An additional important advantage of the

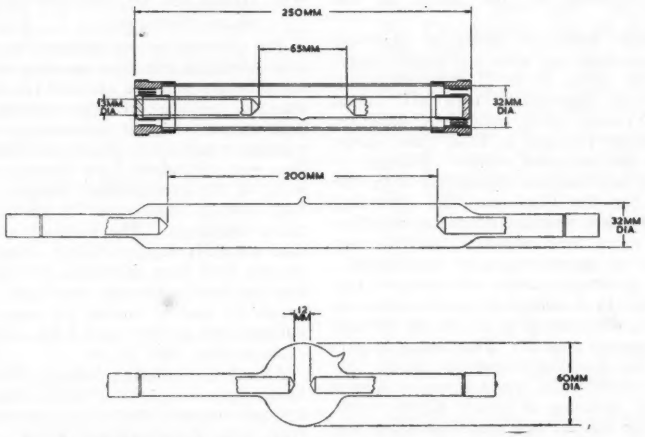


Fig. 1. Standard 5 kw. A.C. Gas Arc in water flow jacket together with two types of experimental air-cooled xenon lamps.

Gas Arc over any source employing high or medium mercury vapour pressures is that full light output may be obtained immediately. There is no "run-up" period before the light source is operationally useful, nor is there need to maintain the lamp in a condition of preparedness by, for example, "simmering" in a lagged oven ([6,7].) Under all conditions the Gas Arc may be switched in and out at full brightness.

4. Development Work Based on the Gas Arc

Experimental lamps evolved from the standard water-cooled Gas Arc have been mainly designed to eliminate both the need for water cooling, which for some applications involves undesirable complications, and the disadvantage of high-voltage starting.

4 (*a*) *Air-cooled Designs*

An obvious way of overcoming the need for water cooling was to design the quartz envelope to be of such shape, size and surface area as to enable the necessary wattage to be used in the arc while allowing the temperature of the walls to remain below a value at which they would soften or undergo severe chemical change. From a knowledge of mercury vapour lamps in both spherical and cylindrical envelopes it was possible to estimate the approximate dimensions which would be needed for any arc wattage. Other factors such as modifications to the electrodes and adjustment of seal parameters were also taken into consideration.

A tubular quartz lamp having an arc length of 200 mm. and a diameter of 32 mm. is of particular interest from an extensive range of possibilities which are being investigated. The physical dimensions of this lamp may be compared with those of a standard lamp from Fig. 1, which to the same scale illustrates diagrammatically the standard Gas Arc and two main experimental designs. The luminous and electrical characteristics of the tubular lamp differed from those given above for the Gas Arc. As was expected, the arc voltage was about 120, requiring a current of about 45 amperes to give a loading of 5,000 watts. The arc stability, whether the lamp functioned vertically or otherwise, was comparatively satisfactory for a lamp of this design. Luminous efficiencies higher than 35 lm./w. were obtained, while the colour of the radiation was still of a Sunlight quality.

This type of lamp was of importance in demonstrating that at moderately high currents through xenon high luminous efficiency and good colour could be obtained; it appeared, indeed, that a high current density could be achieved in the arc as much by the inherently low mobility of the xenon molecules at pressures of the order of one atmosphere as by the con-

straining influence of the walls of the envelope.

A further series of lamps of spherical shape were made up with arc lengths varying between some 10 to 25 mm.—basically they can be regarded as type ME lamps having a xenon filling instead of mercury. It was found possible to load these lamps in air to the expected values. Because of the short arc lengths, compared with the 65 mm. for the Gas Arc, the operating voltage was low and the efficiency therefore was not more than about 20 lm./w. over the range of xenon pressures investigated.

For a particular lamp with an arc gap of 12 mm. in a spherical quartz envelope of 60 mm. diameter (Fig. 1) the arc voltage at 100 amperes was 30. The centre brightness of the arc was found to be of the order of 10,000 stilb, while zones of higher brightness, peaking to some 40.000 stilb, occurred in the arc near each electrode tip. That these higher brightness effects are associated with the particular electrode functioning as a cathode on the respective half-cycle of the alternating current may be shown by operating direct current arcs when even higher brightnesses, for equivalent currents, are produced near the cathode. Although the distribution of brightness in the arc is not the same as for the high-pressure type ME mercury lamp, it is of interest to make comparisons; the formula deduced for the mercury discharge:—

$$\text{Peak brightness at arc centre} = 3x \left(\frac{V}{L}\right)^{1.5} x\ (I)^{0.7} \qquad (8)$$

gives for a hypothetical mercury vapour discharge operating under equivalent conditions of voltage gradient and arc current a brightness of almost the same value; similarly, for a typical 3-kw. mercury arc of practical form, where the arc voltage gradient would be about 94 volts/cm. (75 volts for an 8 mm. arc gap) at 40 amperes, it will be seen that the formula gives a centre arc brightness of 35,000 stilb. The average brightness of the compact source xenon discharge, for a given wattage, can be made almost 2/3 of that for mercury.

The colour of the radiation from this type of lamp appeared to differ to some small extent from that of the Gas Arc; the light contained a greater proportion of energy of shorter wavelength. Whether this effect is due to a greater proportion of line to continuous emission than occurs with the Gas Arc has not yet been determined. For most practical purposes the colour differences between the several experimental types and the standard lamp can be neglected.

4(b). *Design for Arc Initiation with Mains Voltages.*

The compact source mercury vapour lamp when switched out after reaching full operating pressure must be allowed to cool before the arc may be reformed readily; with a high mercury vapour pressure, arc initiation presents a similar problem to "striking" the Gas Arc. Standard 5 kw Xenon lamps, and most of the experimental designs, require a high voltage transformer of about 4 kv., to cause ionisation. The mercury arc at pressure normally requires higher voltages; pulse circuits have been developed for this application but tend to become unreliable with A.C. mains [9] and in almost all cases the peak voltages are greater than 5 kv. and in some cases greater than 25 kv.

At the Lighting Service Bureau on December 11, 1945 [10], a high-pressure mercury vapour lamp of the compact source type was demonstrated which could be switched in and out under all conditions of pressure, and therefore of brightness, by the incorporation of an incandescent auxiliary electrode [11] within the quartz envelope eliminating entirely the need for a voltage of greater value than the usual mains supply.

This principle was subsequently applied in an improved design to overcome the similar problem in an experimental air-cooled compact source xenon lamp. With a gap between the main electrodes of 10 mm. a lamp was prepared with an auxiliary electrode situated approximately in the same horizontal plane as the tip of the lower main electrode and 2 mm. from it at its closest point. Separate leads and seals were brought out of the lamp envelope for connection to this third electrode.

The method of operation and a preferred circuit may be described with reference to Fig. 2. The main electrodes are connected in series with choke L_1, main switch S_1 and the supply voltage. On closing switch S, followed by double-pole switch S_2 current flows through the auxiliary electrode limited by the resistance of the latter and the series reactance of chokes L_1 and L_2; it should be noted that choke L_3 is short-circuited at this stage. When the temperature of the auxiliary is about 2,000 deg. K, a value by no means critical, the double pole switch S_2 is opened; an auxiliary arc forms between the auxiliary and the adjacent main electrode, the current being limited by the series reactance of chokes L_1 and L_3. To obtain a usefully long life from the filament, chokes L_1, L_2 and L_3 should be arranged so that the auxiliary arc current is about $\frac{1}{4}$ of the

current used for producing incandescence. The auxiliary arc provides the ionisation required to "strike" the main arc which forms in practice almost immediately switch S_2 is opened.

The incandescent auxiliary electrode applied to the compact source xenon lamp enables the high voltage initiation of the arc

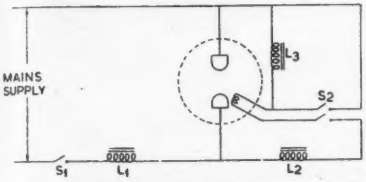


Fig. 2. Circuit for use with incandescent auxiliary electrode in experimental air-cooled compact source xenon lamp.

to be dispensed with; the electrical and luminous properties of the main arc were completely unaffected.

5. Conclusion

The phenomenon of the Gas Arc has been investigated over a wide range of pressures of xenon up to values of the order of five atmospheres and with air-cooled lamps of different form. It has been shown that at pressures of about one atmosphere tubular lamps of arc length greater than the standard lamp give increased luminous efficiency; short arc, compact source xenon lamps, while having comparatively low efficiencies can be made to give high brightness of an order similar to that of the high-pressure mercury lamp, type ME. With both forms the colour of the radiation is of a daylight quality. A design of lamp involving an auxiliary electrode enables the high voltage initiation of the arc to be overcome without affecting its operating properties.

Development work over a still wider range of pressures and operating conditions is proceeding.

This article was based on a paper read before the Exeter Group at the Bath and Bristol Centre of the I.E.S. on October 6 and 7 last respectively.

List of References

(1) Aldington, J. N. and Meadowcroft, A. J., "The Flash Tube and its Applications," J.Inst.E.E., 95, Part 2, 671, 1948.

(2) Meadowcroft, A. J., "High-speed Flash-tubes and Their Applications." The Photographic Journal (Section B), 89B, 1949.

(3) Aldington, J. N., "The Gas-Arc—A New Light Source," Trans. Illum. Eng. Soc. (London), XIV, No. 2, 1949.

(4) Cumming, H. W., "The Gas-Arc—A New Source of Light for Photography," The Photographic Journal (Section B), 89B, 1949.

(5) Schulz, P., Z. Naturforsch, 2A, No. 10, October, 1947.

(6) Francis, V. J. and Stevens, W. R., "The High-Pressure Mercury Vapour Discharge and its Applications," J.Inst.E.E., 94, Part 2, 423, 1947.

(7) Bourne, H. K., "New Discharge Projection Lamps for Studio Lighting," B.T.H. Activities, March, 1947.

(8) Aldington, J. N., "Bright Light Sources, Part II," Trans. Illum. Eng. Soc. (London), 11, No. 2, February, 1946.

(9) Francis, V. J. and Willoughby, A. H., "The Design of Special Circuits for High-Intensity Discharge Lamps," J.Inst.E.E., 96, Part 2, No. 50, April, 1949.

(10) Aldington, J. N., "Bright Light Sources, Part II."

(11) British Patent, No. 573,141 (October, 1945).

Correspondence

Lighting Units

To the Editor of LIGHT AND LIGHTING

Sir,—I think I can recognise "Dimmerwit" sitting in the front row. He has missed the point, of course, in assuming that a change from "foot-candle" is necessary or desirable. Why? I can easily recognise both a foot and a candle, and if I am told that a foot-candle is what I get a foot from a candle I can understand that too.

But before I can understand a "lumen per sq. ft." or some ghastly concoction such as a "lura," I must first understand a lumen, and nobody has yet been able to explain to me exactly what it is. I have "explained" it to others, I admit, by dragging in candles and things called steradians with dubious Greek letters in them, but I am always glad when question-time is over. You see, sir, I have not been educated beyond my intelligence.—Yours, etc.,

"DIMWIT."

London.

Science Museum Lighting Exhibition

The rebuilt Illumination Collections at the Science Museum are now fully open to the public. A description of the first section illustrating historical developments and a number of demonstrations of illumination principles was given in the August issue. The final sections, described below, illustrate discharge tube and fluorescent lighting.

Part of the room in which discharge lamps and the architectural uses of fluorescent lamps are shown.

Discharge lamp exhibits are contained in a room which in itself serves as a demonstration of many different kinds of lighting. The ceiling contains an "egg box" louvre and two decorative metal-grid louvres. The sodium lamp exhibits are lit by sodium lamps, the mercury lamp exhibits by mercury lamps. One row of special lamps is lit by four 8 ft. 6 in. cold cathode tubes, any or all of which can be switched on. The cold cathode tubes themselves may be viewed directly from the switchboard through a small window. Other recesses contain compact source lamps and an exhibit showing the build-up of a fluorescent lamp. Features of this room are illuminated cornices, mirrors, and a fireplace. The various circuits are all led to a single control position, but apart from the four cold cathode lamps and the fully automatic "push-button" build-up of a fluorescent lamp the control must be done by one of the assistants in charge. One of the simple but little-appreciated principles that can be shown to the public is that colour may be obtained by the use of coloured sources and appropriately coloured backgrounds. The four cold cathode lamps also give a colour-mix, when all are on together, that approximates to daylight. They are individually blue, green, pink, and gold.

The visitor leaves the exhibition through a dark, small, low-ceilinged area, in which the principles of fluorescence are demonstrated. After preliminary exhibits stating the nature of fluorescence and showing natural and other substances glowing under long-wave U.V. illumination, the visitor can switch on five discharge tubes showing the discharges obtained with the five rare gases, and a replica of Becquerel's lamp of 1857, in which Willemite crystals fluoresce with a faint greenish light under the influence of a practically invisible induction coil discharge *in vacuo*.

The next exhibit is one for the student, and is, in effect, the mounting of a rather delicate scientific experiment in a form that enables it to be self-demonstrated by the public. A number of strips are impregnated with a variety of fluorescent powders and

arranged one above the other on a screen capable of vertical motion up and down at the turn of a handle. A quartz lamp provides a source of short and long-wave U.V. in addition to the usual visible component. A horizontal spectrum is projected through a quartz prism and two quartz lenses. The bands of fluorescent material are illuminated by the visible spectrum and also glow at those portions of the quartz lamp U.V. spectrum to which they react. These glows are in characteristic colours. A second control knob may be used to bring a piece of glass between the rays and the fluorescent screen. The glass clearly cuts off all short-wave U.V., though part of the glow from the zinc sulphide strip, which reacts to the very long-wave U.V. near the violet end of the visible spectrum, persists. Some of the materials have a very rapid decay period, while others, such as zinc sulphide, continue to phosphoresce after they have been removed from the influence of the spectrum. Illuminated transparencies below the exhibit explain the various principles that are shown by this demonstration.

There is an exhibit of various modern fluorescent materials reacting strongly to short-wave U.V., and there follow two fluorescent lamp circuits to show the operation of the thermal and glow starters and the instantaneous start. Each circuit is push-button operated, and is controlled by a timing motor that resets the push button after an appropriate period. There is then a comparison of tungsten filament and fluorescent lighting and, finally, as a combined demonstration of phosphorescence and the microseconds flash tube, an exhibit has been built in which the visitor can press a button and obtain on a phosphorescent screen a sharp negative image of a hand or a moving object interposed between the flash and the screen. The phosphorescence dies away slowly. After 12 seconds the push-button is reset and a further operation may be tried.

In the course of passing through these attractive rooms, the more serious visitor is able to see much of historical importance, such as a Cooper-Hewitt lamp of 1901, and some of those high-pressure mercury discharge lamps enclosed in fluorescent balloons that so intrigued us in 1937 and may have presaged the beginning of a revolution in the lighting field. There is a 50-kw. experimental compact source lamp of 1948, with annular strip molybdenum leads through the quartz seal, that may well prove historically interesting to some future generation. The seal is certainly representative of some of the solid, unspectacular, expensive, and frequently successful researches that go to the making of a modern lamp. The same adjectives are often applicable to much of the work of the Science Museum, which has to withstand the onslaught of the stupid and the unruly elements that are inevitably to be found among the million or so visitors of all types and classes that attend yearly. It is desirable that they should be unable to harm the exhibits; it is essential that they should be unable to harm themselves.

Where there are high-voltage circuits and lamps that are far more susceptible than tungsten filament lamps to damage by quick-fire switching the precautions, which are hidden, are often as interesting as the exhibits. It was thought, however, that it was asking too much to devise a circuit that would make the architectural room-lighting foolproof, and this has had to be left as a request item. The use of five of the architectural features as recesses in which to house the discharge lamp exhibits was another factor determining the removal from the public of the means for indiscriminate switching of the room-lighting. Many of the exhibits were originally prepared for the "Darkness into Daylight" Exhibition, held at the Science Museum in 1948. For many exhibits, and for much of the equipment installed, the Museum is indebted to the members of the Electric Lamp Manufacturers Association.

"Trigonometry Without Tears"

An ingenious slide-rule for solving simple problems in trigonometry has been produced by Holophane, Ltd., Those who spend anxious minutes with cosines and angles will welcome this "Angle Calculator." The problem which confronted the designers of this slide-rule was to find the angles in plan and elevation from a lighting fitting to a test point when the distances in length, width and height were known and then to find the angle of incidence of the ray on a non-horizontal test surface. When this problem had been solved, the writer of the instruction booklet for the slide-rule set to work to find what else it would do and produced an impressive series of solutions to problems which occur frequently in polar geometry, vector diagrams, optical ray tracing, map projections and perspective drawing. This rule is a companion to the Holophane "Illumination Calculator." It is sold at £2 2s., and may be obtained from Holophane, Ltd., Elverton Street, London, S.W.1.

Lighting an Oil Jetty

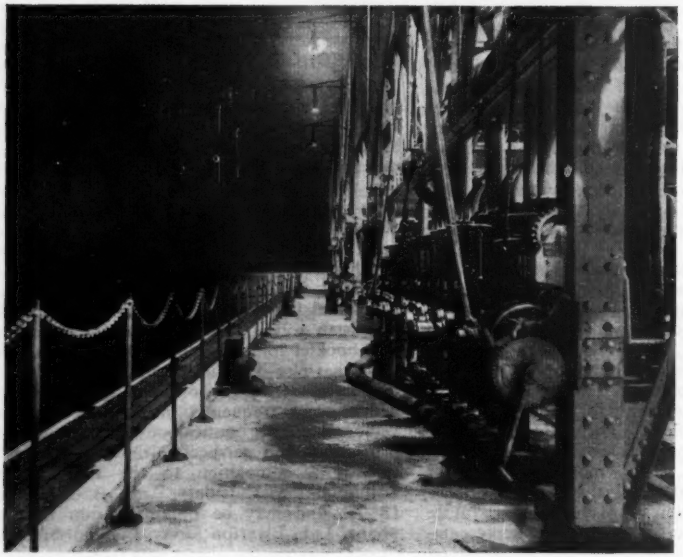
Description of a recent floodlighting installation at the Shell-Mex and B.P., Ltd., installation at Hamble, which is designed to deal with increasing tanker traffic.

To cope with the increasing tanker traffic on all tides a new floodlighting system has been installed by Shell-Mex and B.P., Ltd., on their Hamble Installation Jetty No. 2. It is believed that the intensity and distribution of the lighting surpasses any other form of lighting used in connection with oil jetties.

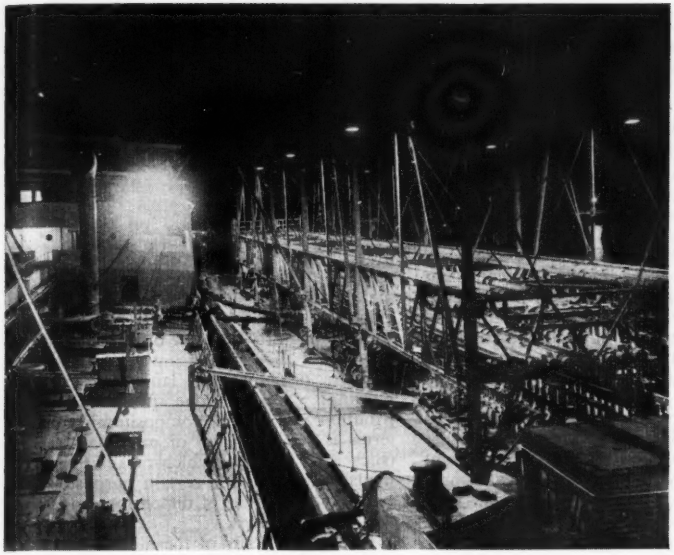
The type of products handled at the jetty justified the use of certified flameproof electrical equipment Group 2. Such equipment has been approved by the Testing Department of the Ministry of Fuel and Power (Coal Division).

Many operations are performed on and around the jetty during the hours of darkness. Block floodlighting has therefore been applied to cover the entire deck of the jetty and to extend about 30 or 40 ft. beyond the edges. In this way the small bunkering craft, which rise and fall with the tides, are illuminated. The equipment has been designed to avoid a serious cut-off of light over the sides of the jetty, particularly at the points where men leave the ladders or staging to transfer to the craft. Direct lighting could not be applied to these points, but reflected light has proved adequate. Eleven 500-watt G.E.C. ZF 16531 certified flameproof lighting units are mounted 28 ft. above the jetty, 40 ft. apart. Raising and lowering equipment is provided for maintenance.

This type of lighting unit was originally designed for use in mines and weighed 95 lb., but the weight has been reduced by half by manufacturing the units in alloy. The fittings, moreover, gave a beam of light which was of narrow angle and also could not be shone at an angle of less than 45 deg. to the downward vertical. Treatment of the reflectors with a special paint increased the



The new floodlighting provides an average intensity of light of 1.9 ft.c. on both sides of No. 2 Jetty of the Shell-Mex and B.P., Ltd., Hamble installation.



Showing tanker discharging at No. 2 Jetty. Eleven 500-watt G.E.C. flameproof lighting units are mounted 29 ft. above the jetty and 40 ft. apart.

width of the beam and distributed the light evenly when the fitting was mounted vertically. Photometry readings showed an average intensity of light of 1.9 ft.c. on both sides of the jetty and 2.0 ft.c. immediately beneath each lantern.

The intensity of the lighting on the approach to the jetty is arranged to avoid serious reaction on the operating staff on arriving at or leaving the jetty when the floodlighting system is in full operation. The lighting fittings on that part of the electrical installation were supplied by the Revo Electric Company and the flameproof prismatic fittings by Walsall Conduits, Ltd. The raising and lowering equipment was supplied by the London Electric Firm, Croydon.

The electrical installation is served by two P.I. armoured cables operating in parallel. That arrangement avoided the complications of manipulating approximately six tons of cable on one drum along the narrow approach to the jetty. Moreover, the cable joints had to be restricted as far as possible, as their construction necessitated employing heat, which would have been inadvisable because of the proximity of the main pipelines. The cables are designed to carry the combined lighting and heating requirements for Jetties Nos. 1 and 2, plus 20 per cent. additional loading reserved for future developments. This arrangement avoids an excessive voltage drop, which would be detrimental to the efficiency of the floodlighting system.

The dolphin or navigation lights are served by a separate cable interconnected with a stand-by generator, which is brought into operation immediately there is an interruption in the public electricity supply.

The lighting standards on Jetty No. 2, of unusual design, were made by the Hamble Installation staff. The electrical construction was undertaken by Messrs. Troup, Curtis and Co., Ltd., in co-operation with the G.E.C.

We are asked to announce that copies of the proceedings of the National Illumination Committee Congress, 1931 (Vols. I and II), are still available. Anyone wishing to obtain copies are advised to make application as soon as possible to Mr. L. H. McDermott, 52, Kings Drive, Surbiton, Surrey.

It is announced that a Street Lighting Conference, arranged by the E.L.M.A. Lighting Service Bureau, is to take place at the Midland Hotel, Temple Street, Birmingham, on April 5. Three papers are to be given, starting at 2.15 p.m. with a paper on "Design," by Mr. W. Robinson, followed at 3.30 p.m. by "Lamps and Equipment," by Mr. H. E. G, Watts, and at 4.30 p.m. by a lecture on "Economics," by Mr. F. Jamieson. Any interested persons are welcome to the conference, and applications for seats should be made to Mr. F. Jamieson, 2, Ainsdale Road, Western Park, Leicester.

Problems in Illuminating Engineering For Students

By S. S. BEGGS, M.A., F.I.E.S.

7. *Light Sources*

A knowledge of the form, operation and characteristics of the more common light sources is essential to all concerned with the lighting industry. The general features and simpler characteristics of such sources have already been covered in the Intermediate Grade course, but it should be remembered by the candidate for the Final Grade examination that the examiner may ask questions on matter included in the Intermediate syllabus, and information requested on light sources is likely to include at least some of the earlier work.

Unfortunately it is generally not easy to become really familiar with lamps using different fuels. The examiner sometimes recognises this fact by setting alternative questions (or parts to a question) relating to the two main divisions — combustion (gas or vapour) lamps and electric (incandescent or discharge) lamps. A good practical working knowledge is expected to be shown by the candidate who chooses to attempt the question in the examination.

If the candidate intends to include the "gas" lamp question among those he will answer, he should pay particular attention to high and low pressure (coal) gas lamps, acetylene and paraffin oil and vapour lamps. (These last are still in considerable use, not only in country districts, but for lighthouses, buoys, railways and similar purposes.) The importance of correct aeration and of burner design, the part played by the mantle, the approximate light output, luminous efficiency and life of different forms, and the effect on these quantities of variation in the gas composition, specific gravity and pressure should be studied. As the performance of the light source is so much affected by the aeration, the light source cannot be studied usefully apart from its housing, and common forms of lanterns in modern usage should therefore be known.

In considering electric lamps, the form, construction and operation of all the commoner types (incandescent, carbon arc or discharge) should be known, with approximate data on their light output, luminous efficiency and life, and their characteristics with change of voltage or other factor which may affect them significantly (such as temperature of fluorescent lamps, or angle of burning). A knowledge of their light distribution and spectral composition in general terms is required, and of any characteristic (such as brightness) which makes them particularly suitable for certain purposes. Detailed specifications of dimensions, etc., need not be memorised.

In discussing any of these data, in answer to a question, it is always its significance in relation to the use of the lamp as a practical light source for the purpose under consideration that should be stressed, rather than the purely physical or chemical property or law that is involved.

Question 12 (1943).

Write an account of the 5-ft. tubular fluorescent lamp, giving particulars of its construction, circuit auxiliaries and starting arrangements. What are the effects of changes of supply voltage and of surrounding air temperature on the life, light output and efficiency of the lamp?

Answer

(i) THE CONSTRUCTION OF THE LAMP, AND AUXILIARY EQUIPMENT.

The tubular fluorescent lamp is essentially a glass tube, of which the inner surface is coated with fluorescent powder, containing mercury vapour at low pressure and having an electrode sealed into each end. The ultra-violet radiation produced when a discharge through the vapour takes place activates the fluorescent powder, which is the source of the majority of the light from the lamp.

In practice the tube is 1½ in. in diameter and approximately 5 ft. long. The fluorescent coating is of specially prepared chemicals (usually silicates, borates or halophosphates) which are responsive to the short wave u.v. radiation at 2537 Å. and

The first article in this series appeared in Vol. XLII, No. 9, September, 1949.

of which the light emitted by fluorescence has a reasonably "white" colour. As the arc temperature is low, the powder can be placed inside the tube and in contact with the discharge, thereby making maximum use of the u.v. radiation.

The electrodes are made in the form of coiled filaments, coated with a material which emits electrons freely when hot. To protect the coils and to reduce the resistance of the electrode during the half-cycle when it is acting as anode, a small plate is welded alongside the coil, to form one termination of the discharge during alternate (positive) half-cycles.

The discharge has a negative resistance characteristic, so that a ballast impedance must be included in the circuit; it should be sufficient to absorb about half the normal supply voltage. On D.C. it must necessarily be in the form of a series resistance, but on A.C. it can with advantage be a choke coil, which will provide the desired voltage stabilisation with only a low loss of power. As the power factor then is only about 0.5, a 7½ mfd. condenser is usually connected in parallel with the lamp circuit, to raise the power factor to about 0.9.

Although about 100 volts is sufficient to maintain the discharge, some special device has to be adopted to initiate it, and usually a "starting switch" is included in the circuit of the lamp. Two forms are in general use, the glow and the thermal types. Both use a bi-metal strip to make and break the circuit; in the former it is heated by a negative glow discharge in a gas such as helium or argon at low pressure, and in the latter by means of a small heater coil. The function of the starter switch is two-fold. Firstly, it allows current to flow through the electrodes of the tubular lamp and heat them to the requisite temperature before the arc is struck; and secondly, by breaking an inductive circuit it causes the voltage between the electrodes to be much higher than that of the supply mains at the instant of striking. A small condenser is usually connected across the switch, to prevent radio interference.

Other arrangements are sometimes used, for example the "instant-start" circuit employing a stray-field auto-transformer and an earthed strip running the length of the lamp; but the starter-switch circuit is by far the most common.

(ii) Effect of Changes in Supply Voltage and of Surrounding Air Temperature.

An increase in supply voltage rapidly increases the lamp current, and overheats the electrodes, thereby shortening the life of the lamp. The light output increases at about the same rate as the supply voltage, but the power consumption in the lamp increases rather more rapidly, so that the luminous efficiency of the lamp decreases.

Decrease of mains voltage similarly leads to a decrease in light output, and although the luminous efficiency is increased, the voltage across the lamp *rises* and operation of the lamp tends to become unstable. If the voltage drop is excessive starting may be uncertain, and as the reduced lamp current is insufficient to maintain the electrodes at their correct operating temperature the life of the lamp again is decreased.

A high operating temperature increases the vapour pressure and current in the lamp, which has a deleterious effect on its performance. A low temperature also results in a marked reduction in light output, the lamp being designed to give maximum light output at a wall temperature of about 50 deg. C., which occurs when the surrounding air temperature is about 20 deg. C. As the power taken by the lamp varies only slowly with ordinary changes in temperature, the luminous efficiency also is a maximum under these conditions. A low temperature reduces the mercury vapour pressure and makes starting of the lamp difficult; frequent attempts at starting will shorten the life of the lamp.

Question 13 (1948)

Trace the changes which take place in the radiation emitted by an electric discharge in mercury vapour as the mercury pressure is raised from a small fraction of an atmosphere to many atmospheres.

Describe practical application as light sources of any of the phenomena to which you refer.

Answer

The radiation from an electric discharge through mercury vapour at a pressure of a few hundredths of a millimetre is largely (approx. 60 per cent. of the power input) in the short-wave ultra-violet part of the spectrum. This radiation is absorbed by the envelope of the discharge in a plain glass lamp, but is made use of in the tubular fluorescent lamp, in which the inner surface of the tube is coated with a powder which absorb this radiation and converts a high proportion (about one-third) into visible radiation by luminescence. By suitable choice of the phosphor, light of different spectral composition can be provided at a high luminous efficiency; white light of different degrees of warmth of tone is ob-

tainable at an efficiency around 40 lm./W. Coloured light, for display or theatre lighting, can also be obtained in a wide range of colours.

At a pressure of the order of 1 mm. the visible radiation—about 1½ per cent. of the power input—is mainly in the blue and green, resulting in a pale blue colour with a luminous efficiency of 10 to 15 lumens per watt. The discharge is of low brightness (2 to 3 stilbs) and fills the whole tube. The colour can be modified by the use of blue or green glass for the envelope, to provide more saturated tones of these colours with efficiency between 5 and 15 lm./W. Such lamps are very effective for floodlighting, as the coloured light is obtained with a luminous efficiency considerably greater than that possible with incandescent sources.

As the vapour pressure is further increased, the arc contracts into a narrow column between the electrodes, and its temperature and brightness increase. The luminous efficiency of the discharge also increases, rapidly at first, but more slowly later, as the proportion of the power input radiated in the visible region of the spectrum increases to a value of the order of 10 per cent. A greater proportion of the light is radiated at the longer wavelengths, and a background of continuous radiation is introduced, which tends to make the light more "white."

The increase in luminous efficiency of the discharge is made use of in the H.P.M.V. lamps used for street lighting and industrial lighting, for which the luminous efficiency is of the order of 40 lm./W. In the higher wattage range a vapour pressure of about 1 atmosphere is used; in the lower wattage range the pressure is further increased to about 5 atmospheres, to counteract the tendency for luminous efficiency to drop with power. A practical luminous efficiency in excess of 60 lm./W. has been obtained in high wattage lamps; the theoretical maximum value would appear to be about 80 lm./W.

High pressures have been used in lamps for projection, in which high brightness of the source is the major consideration. These lamps have about 5 per cent. of red light in their spectrum. In air-cooled types pressures of 5 to 15 atmospheres are usual, with arc brightness of the order of 1,000 stilbs for a line source and 20,000 stilbs for a compact source (short arc length). Short linear arcs, in water-cooled quartz capillary tubing, have been made, operating at a pressure of the order of 100 atmospheres and providing a source brightness up to 100,000 stilbs. Practical conditions (in relation to temperature and pressure) set a limit on the brightness attainable, which is theoretically unrestricted. Power dissipation per unit arc length is a major factor as well as the pressure in the lamp.

The Ultra-Violet Radiation from Fluorescent Lamps

In a paper published in the February issue of the "Revue d'Optique," Dr. R. Latarjet, deputy director of the Pasteur Laboratory of the Institut du Radium in Paris, gives a very interesting discussion of the possible effects of ultra-violet radiation from fluorescent lamps. He compares the radiation due to these lamps, when the illumination produced is 20 lm./ft.^{2}, with that experienced under various conditions out of doors. Even at mid-winter the solar illumination at ground level is still some three times as great as that from the lamps, and at midsummer it is over 140 times as great.

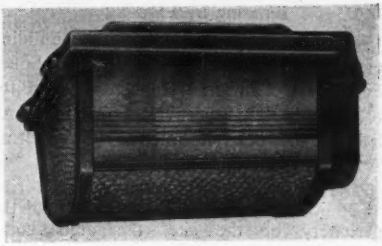
Dr. Latarjet then goes on to discuss the amount of ultra-violet necessary to produce erythema (reddening of the skin), and he shows that no such effect can ever be produced by a fluorescent illumination of the value stated because below a certain intensity, which is some 10 times that given by the lamps, continuous radiation fails to produce any effect as its action is completely nullified by the normal physiological recuperative action. Still less can any effect be produced on the cornea of the eye as the dose needed for this is greater than the minimum amount required to give an erythemal effect. There is, nevertheless, a very small chance that a slight effect may be produced on hypersensitive individuals numbering less than 1 in 1,000 of the population.

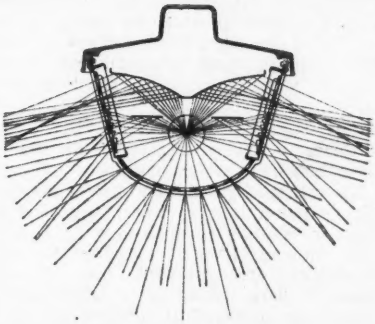
When the lamps are used close to the eyes certain precautions are necessary though, as Dr. Latarjet points out, these precautions are little more than generally accepted principles of good lighting. Direct radiation or specular reflection of the radiation to the eye must be avoided. If the surface viewed is illuminated to a high value, such as 50 lm./ft.^{2}, and is a good reflector of ultra-violet radiation, it should be small in area to preclude any possibility of harmful effects occurring over a long period of time.

Street Lighting at Altrincham

A new street lighting installation at Altrincham, near Manchester, which has been planned under the direction of the Borough Surveyor, Mr. E. S. Hodgson, comprises some 69 400-watt mercury vapour discharge lamps housed in Revo "Silverblue" lanterns. The mounting height is 25 ft., the columns being spaced at intervals of 120 ft. The columns are Revo "Phideas" artificial stone standards with brackets. The erection and installation was carried out by the Revo street lighting department.

The lantern used in this installation incorporates a special system of light control by reflectors and refractors. The body work of the lantern consists of two single-piece die-castings in high quality aluminium alloy, forming the main upper canopy and the lower portion, which is glazed. The canopy is adapted for side or top-entry bracket, and the lower portion is hinged to the canopy so as to swing away from the column when opening the lantern. Strong double toggle-action fasteners of stainless steel are provided to close the lantern securely, and a gasket is fitted to prevent the ingress of dust or moisture. The glazing consists of two refractor panels with smooth cover glasses and figured glass for the remainder. Each refractor panel has a plain upper section and a prismatic lower section. There are two specular reflectors of polished stainless steel on each side of the lamp. All available light is usefully controlled, only about 5 per cent. of the total output being lost in the upper hemisphere. Glare is minimised by rapid reduction of the candle power at angles approaching the horizontal.





(Above) Illustration and diagram of the 'Silverblue' lantern.

(Below) Showing the installation at Altrincham

New Lighting Installations

Building by Floodlight

To assist night work during the building of the new L.C.C. Concert Hall on the South Bank by Holland and Hannen and Cubitts, Ltd., for the 1951 Festival of Britain, floodlighting has been installed by Engineering Service Installations, Ltd.

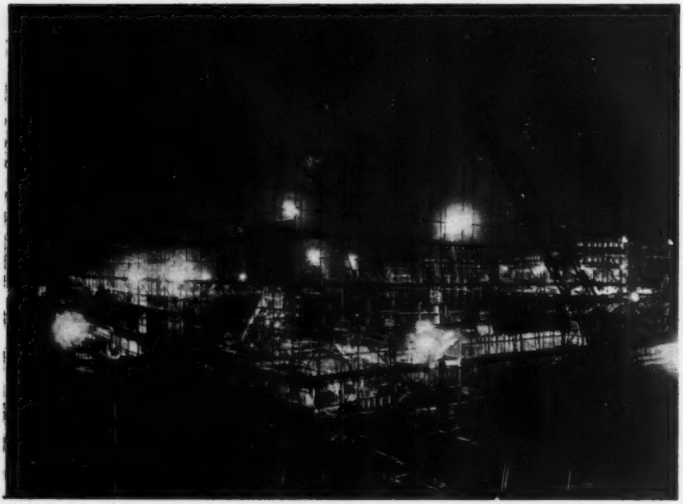
The main installation consists of a ring of 500-watt floodlight projectors around the periphery of the site, the units being mounted on the framework of scaffolding and rising floor-by-floor as the building progresses. These provide the basic overall lighting of the open areas and ensure good illumination of both horizontal and vertical surfaces with a reasonable freedom from glare.

Advantage has also been taken of the existence of towers, erected for the use of surveyors, upon which have been mounted 1,000-watt spotlight units to give additional illumination over the central area, and to assist in ensuring adequate lighting at difficult working levels. Portable 500-watt floodlights are provided for boosting localised dark areas as required, while sockets are arranged at strategic points to allow the use of hand lamps for the inspection of deep cavities.

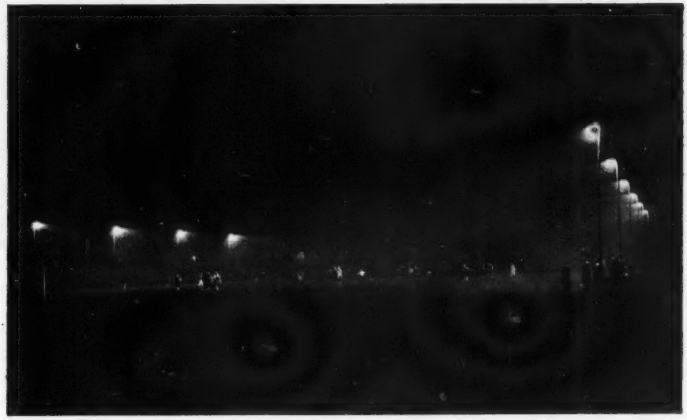
As the building construction proceeds and shuttering and concreting is in progress, the lighting between floors is provided by floodlights trained upwards on to the underside of the upper floor, thus giving indirect lighting to these enclosed areas. In this way, a reasonable degree of illumination is ensured with the minimum amount of shadow. As work is completed in these between-floor areas and scaffolding removed, it is proposed to install a temporary system of general lighting with standard dispersive reflectors which will remain until the final permanent installation is completed.

The nature of the constructional work undertaken and the rapidly changing scene over a large area of operations presented many difficulties and precluded the installation of a normal overhead lighting scheme, yet demanded a standard of illumination which would ensure safe and efficient working conditions after dark.

Since the system is flexible and the number of units varies according to the day-to-day requirements of the building operations, the total loading of the installation fluctuates, but at present it is about 50 kW.



Construction of the L.C.C. Concert Hall on the South Bank of the Thames continues at night by floodlight. *(L.S.B. photograph).*



Floodlighting on the Ipswich Town F. C. practice ground.

Floodlighting for Football

Many football clubs are equipping their grounds with floodlights in order that their teams may practise in the late afternoon and evening. The illustration above shows Ipswich Town Football Club's practice ground, which is illuminated by twelve Benjamin Duoflux floodlights, each with 1,500-watt lamps and mounted on 30-foot poles. The installation was carried out by the Eastern Electricity Board.

Lighting in a Car Showroom

The lighting of a motor car showroom calls for high intensities of diffused illumination evenly distributed over the whole of the selling area, with the illuminants so arranged that not only is top lighting satisfactorily achieved but the sides of the car bodies are adequately lighted. Top lighting is easily achieved by the use of large area diffusing fittings which have a low surface brightness, but side lighting always presents a problem

Fluorescent lighting in a car showroom.

owing to the direct glare from the fittings and the reflected glare from the polished surface of the car bodies.

An interesting installation is that in the showroom of Messrs. T. Mellor, Ltd., Deansgate, Manchester. Overhead lighting is provided by means of "Atlas" totally enclosed ribbed "Perspex" diffusing fittings, mounted on the transverse beams, whilst side lighting comes from "Atlas" twin 2-ft. 40-watt units with crinothene diffusing media around the tubes. Although mounted fairly low, the extremely low brightness of these units provides comfortable glare-free illumination of high intensity.

Fluorescent lighting in a Middlesbrough hosiery factory.

Lighting in a Hosiery and Knitwear Factory

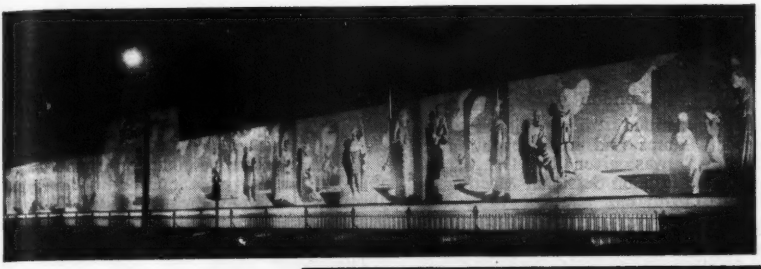
In a very comprehensive lighting scheme installed recently in the factory of Messrs. Foister, Clay and Ward, Ltd., at East Middlesbrough Trading Estate, a total of 444 "Mazda" fluorescent lamp fittings are used. They are all of a uniform type and have stoved enamel reflectors with slots to allow a proportion of light to escape in an upward direction. Each fitting houses a single 5-ft. 80-watt fluorescent lamp.

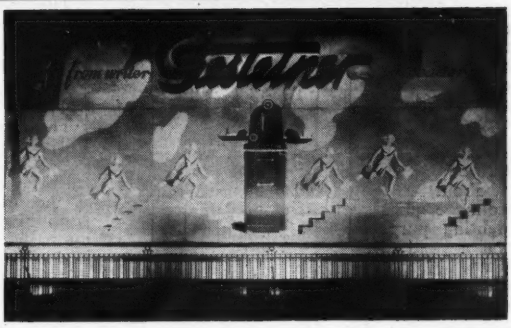
The installation may be described generally as semi-local. That is to say, lighting units are mounted at regular spacings and heights throughout the several sections of the factory, but work-benches and machines have been arranged so that wherever possible a row of fittings is directly above, or adjacent to, each working position. The lighting in the various departments may usefully be noted in detail.

Winding Section.—In this section three rows of machines spool the cotton and wool yarn in preparation for the knitting process. Fittings are mounted in rows between the lines of machines, spaced at 10-ft. intervals with 10-ft. lateral spacing between rows. Mounting height of 8 ft. 9 ins. gives a lighting intensity of approximately 15 lm./ft.^{2}, on the working plane, considered adequate for the detection of breaks in the yarn, machine faults, etc.

Knitting Section. — Fifty-four knitting machines are arranged in lines, with the lighting fittings again spaced at about 10 ft. by 10 ft., and again running in rows down the centre of each gangway between the lines of machines. The height of the machines made it desirable to increase the mounting height of the fittings to 9 ft. 6 ins., reducing the illumination level to an average of 12/13 lm./ft.^{2}. This, however, is considered entirely satisfactory for the visual tasks involved.

Making-up Section.—Here a number of processes are carried out by rows of small, bench-mounted machines. The benches are some 10-ft. apart, and in every case except one a row of fittings, spaced at 8-ft. 6-in. intervals, is positioned over the centre of each bench. Mounting height is 7 ft. 9 ins. above the floor (5 ft. above the benches), this





(Above) General view of the floodlighted mural sign outside the premises of Messrs. Gestetner Ltd.

(Right) View of the central panel of the sign.

arrangement giving good general lighting (15 lm./ft.²) with maximum intensity directed on to the working area at bench level. The processes covered in this way are: Elasticating, overlocking, lockstitching, overlock edging, shell edging, cross-stitch, and welting.

In addition, special attention is given to the area where flat-lock machines are in operation. With multiple parallel rows of stitching being carried out simultaneously the visual task is much more critical; the lighting fittings over this area are, therefore, mounted in continuous trough formation at 3 ft. above machine level and about 2 ft. 6 ins. away from the bench. The trough rows are tilted approximately 15 degs. from the vertical so that maximum light intensity is directed over the shoulders of the operatives from above and behind. An average level of illumination of 35 lm./ft.² results on the machines.

Cutting Department.—Portable band-saw cutters on a wide bench cut the knitted material to shape. A row of lighting fittings mounted at 5 ft. above the bench centre, spaced at approximately 8 ft., gives an average of 25 lm./ft.².

Pressing Department.—In this area, where steam pressing machines are situated, light intensity of 22 lm./ft.² on the working plane is achieved by a row of fittings at 8-ft. 10-in. intervals mounted above the heads of the operatives at 8 ft. 6 ins. from floor level.

Mending and Hand-pressing Sections.—These consist of two adjacent benches, one fitted with a number of hand-operated electric irons. Each bench area is lit by a row of fittings over its centre, 3 ft. 9 ins. above bench level at 8-ft. spacing. Lighting intensity averages 30 lm./ft.² over both sections.

Packing Section. — General lighting of 20 lm./ft.² at bench level results from fittings mounted at 9 ft. 6 ins. above the floor, spaced at 10 ft. by 10 ft.

The lamps and fittings used were supplied by the British Thomson-Houston Company, Ltd., and installed by Messrs. J. W. Squire, Ltd., electrical constractors, of Humberstone-road, Leicester.

FLOODLIGHTING

A mural sign, over 250 ft. long outside the premises of Messrs. Gestetner, Ltd., in North London, is now floodlighted every night by 13 G.E.C. 1,000-watt floodlights, which are placed 7 ft. from the base of the sign at intervals of 10 ft. The pictures are shown above.

I.E.S. ACTIVITIES

London

A paper entitled "The Dimming of Fluorescent Lamps and its Application to the Theatre" was given by Dr. J. W. Strange at the London Sessional Meeting on February 10.

The high efficiency of low pressure fluorescent discharge lamps and the wide range of colour which can be obtained with them are obvious points which recommend these lamps for use in theatre lighting. They have not previously been used for this purpose due to the lack of a satisfactory method of controlling the light output of these lamps.

A circuit was required which would give with complete reliability a range of dimming of about 300 to 1. And one was developed from the quick-start circuit used for general lighting purposes. One essential feature was a good earth in close proximity to the lamp. According to the distance and area of an earthed metal plate the striking volts of an 80-watt lamp may vary between 170 and 270 volts. The next stage to extend the range of dimming was a quick-start circuit for operating two or more lamps in series. Further study of this and other circuits showed that the limitation of the range of dimming was due to three factors:—

1. As the line voltage was decreased the discharge current and the current derived from the quick-start transformer were reduced and the point was reached at which the cathodes ceased to have sufficient thermionic emission for hot cathode operation.
2. The applied voltage was insufficient to initiate a discharge although the same voltage might be sufficient to maintain a discharge once it was established.
3. The drop of voltage across the choke was insufficient to ensure stable operation.

Two additional requirements were necessary to deal with these three factors. The first was that the electrodes must be maintained at emissive temperature over the full range of operation. This was achieved in a number of ways, one of the simplest being by connecting primary winding of the quick-start transformer direct to the supply and quite independently of the lamp-dimmer circuit. The second requirement was the use of a separate variable impedance in series with each lamp. The variable impedance was preferably in the form of a resistance although an inductance such as a saturable reactor sould be used. The final range of dimming obtained exceeded 300 to 1.

A wide range of colour was made available by the use of a number of different phosphors such as the tungstates, silicates and borates. A few of the more saturated colours needed the addition of filters.

The point about the new fluorescent system which has attracted most attention from producers has been the quality of the lighting, but the other principal point of difference is the high efficiency in comparison with incandescent lamps and filters.

The comparison between the two systems will depend on a number of variables such as lamp voltage and colour. The efficiency of the incandescent lamp increases as the wattage increases, but the 150-watt. lamp may be taken as typical of the size normally used, with an average efficiency of 12.5 lm/w. The use of a filter reduces this figure by a varying amount according to colour. If filters Nos. 6, 39 and 20 are taken as a representative group their efficiency figures fall to 2.4, 2.7 and 0.4 lm/w. The efficiency of fluorescent lamps also varies with size and loading. The relatively inefficient 2-ft. 40-watt lamp has an average efficiency through life for "daylight" of 26 lm/w, but has the widest range of dimming. The corresponding figure for the 80-watt lamp is 35 lm/w and for the 4-ft. 40-watt lamp 38 lm/w. In comparing an incandescent lamp without filter with a fluorescent lamp it will be seen that there is a gain of between 100 and 200 per cent. in efficiency, according to size. The advantage of the fluorescent lamp becomes very much more marked when a change is made to coloured lamps. The average efficiency figures for colours very similar to incandescent lamps and the filters referred to above, are 10, 16 and 31 lm/w., respectively.

Leeds Centre

The February meeting of the Leeds Centre was held at the Leeds Lighting Service Bureau Lecture Theatre, when Mr. E. J. Stewart, of Glasgow gave a paper on "Street Lighting—Its Background."

Mr. Stewart based his discussion on Group "A" traffic route installations and used over a hundred slides to illustrate his points. He discussed the use of backgrounds for seeing the street and the objects in the street at night by brightness contrast. At night, the majority of objects in the street are seen as dark objects against a brighter back-

ground—the brighter and more even the background the better, so long as it is not glaring. The driver must be able to discern the silhouette in front of his vehicle and be able in a moment to judge its approximate distance. If this can be achieved the finer details of the objects are of little importance.

Although the lamps which provide the reflection from the roadway, against which objects are seen at 100 yards and less, may themselves be several hundred yards away they may be of greater importance in revealing the objects than are the lamps near the objects.

The discussion was opened by Mr. L. A. Doxey, head of the Leeds Lighting Service Department. Others taking part included Mr. Howell and Mr. Schofield of Huddersfield.

The Nottingham Centre Dinner Dance. Seated at the top table: Mr. R. H. Ellis, Chairman, Councillor L. H. Willson, Sheriff of the City of Nottingham, Mrs. R. H. Ellis, Mr. and Mrs. N. F. Marsh, Mr. G. C. Small, Vice-Chairman and Mrs. Small.

Manchester Centre

A very successful lunch was held at the Midland Hotel on February 9 by the Manchester Centre, in honour of the president, Dr. J. N. Aldington, who is a member of that Centre.

The toast of the City and Port of Manchester was proposed by Mr. H. Hewitt who, in an extremely witty and amusing speech, made reference to the progress which had been made by the city in street-lighting and in education.

Replying to the toast, the Lord Mayor of Manchester, Alderman R. Moss, J.P., thanked Mr. Hewitt for his remarks, but said that he felt that the street-lighting in Manchester could still be improved. All local authorities were handicapped in what they would like to do by the financial aspect. He also suggested that steps should be taken as quickly as possible to secure standard street-lighting between various towns and boroughs which, in his opinion, would help considerably to reduce the number of accidents at night. Great advances in lighting had been made and these had been due largely to the work of the I.E.S. There were, however, very many factories with inadequate lighting, and great care should be taken to sell factories *lighting* rather than lighting fittings. He said that the work of the I.E.S. as a cultural society was greatly appreciated, and as such they were very welcome in Manchester, where their work was widely recognised.

The toast of the Society was proposed by Sir Joseph Hallsworth, chairman of the North-Western Electricity Board, who also paid tribute to the part played by the I.E.S. in the advances in the science of lighting. These advances in apparatus and technique, however, were far ahead of application, this time-lag being quite often due to inertia on the part of users. Postponement of the adoption of some advances might possibly be justified on the grounds of cost, but there were others which could not be postponed in this way. He said that the problem of the Society was to brighten people's lives—to help them to see things as they have never seen them before, to illuminate the mind of the community so that it will, in all respects, be able to see its way.

The reply to this toast was made by Dr. J. N. Aldington, who said that he was very

touched that the Centre should have arranged this lunch particularly in his honour. He said it was due to Mr. Alan Owen, hon. assistant secretary of the Centre, that he had first joined the Society, and ever since he had been grateful for the fellowship he had found in the I.E.S. The strength of the Society was not so much in its numbers, but in the strength of its beliefs and in the examples of those who built up the Society in the first place. He said that other speakers had referred to work yet to be done, and he agreed that in the future lay the greater work of the Society.

The toast of the guests was made by Mr. H. Atherton, past chairman of the Manchester Centre, and the response was given by Mr. C. C. Smith, chairman of the Liverpool Centre.

Nottingham Centre

The Annual Dinner Dance of the Nottingham Centre took place on Friday, February 10, at the George Hotel, Nottingham, when the chairman, Mr. R. H. Ellis, and Mrs. Ellis welcomed well over 100 guests, including the Sheriff of the City of Nottingham, Councillor Leon H. Willson and his daughter, Miss Margaret Willson, Mr. L. J. Davies (vice-president of the Society), and Mrs. Davies, and Mr. N. F. Marsh (Chief Commercial Officer of the East Midlands Electricity Board) and Mrs. Marsh.

In proposing the toast of the "City of Nottingham" the chairman referred to the part that good street lighting played in the prevention of accidents and said that the standard of such lighting in Nottingham was appreciably higher than in many towns of equivalent size. The Sheriff of Nottingham, in reply, said how glad he was to be present and as vice-chairman of the Highways Committee he endorsed all that Mr. Ellis had said on the question of public lighting and also the part the Society had played in promoting good lighting in shops, factories, offices, etc.

The toast of "The Ladies" was wittily proposed by Mr. R. G. Pickford, and Mrs. R. H. Ellis replied.

Mr. N. F. Marsh, in proposing the toast of "The Illuminating Engineering Society," referred to the invaluable contribution it had made to the science of lighting since it was founded over 40 years ago. Mr. L. J. Davies, in reply, said how glad he was to be able to come along as a deputy for the President, Dr. J. N. Aldington, who was unable to attend owing to a prior appointment.

Sheffield Centre

The monthly meeting of the Sheffield Centre was held in the medical library of Sheffield University on February 6, when an interesting and instructive lecture was given by Mr. H. L. Privet on "The Latest in Electric Lamps."

The lecturer first dealt with developments in infra-red lamps, which have been much used for rapid paint drying during manufacturing processes during the past few years. Some design details of fluorescent lamps gained by operational experience were then given by Mr. Privet, who mentioned that, if the voltage drop of lamp or tube was limited to 60 per cent. of the mains voltage, a steady light output would be obtained during voltage fluctuations which are now experienced at peak load in certain parts of the country. Demonstrations of fluorescent tubes of various lengths up to 8 ft. 6 in. with voltages of 6 to 200 were then given with full colour ranges.

Some useful advice given by Mr. Privet was to renew tubes immediately on failure, otherwise starter trouble may be experienced, resulting in premature failure of tubes afterwards fitted. It is often advisable to renew starter switches and tubes together.

A recent development was a 1½ kw. high-pressure mercury vapour lamp with an operating efficiency of 50-55 lumens per watt, generally used for high bay illumination of factories, store-houses, etc. Further uses of the H.P.M.V. lamp are for light-houses and film projectors, including a 250-watt size with an arc length of 0.3 cm., sometimes used for 16mm. film sets.

The lecture concluded with details of H.P. mercury-cadmium lamps, which are operated at a pressure of 10 atmospheres, giving good colour rendering in sizes from 1 to 5 kilowatts. Demonstrations of high-speed electronic flash equipment were also given by the lecturer.

A vote of thanks to the lecturer was proposed by Mr. L. A. France. The attendance was a record for the Sheffield Centre, over 80 members and guests being present.

Stoke-on-Trent Group

The Stoke-on-Trent Group recently held their second annual dinner, at the Borough Hotel, Newcastle-under-Lyme, when over 50 members and guests were present. The principal guest was Mr. H. A. P. Caddell, North Staffordshire Sub-Area Manager, Midlands Electricity Board.

In his speech, in which he proposed the toast to the Society, Mr. Caddell paid tribute to the work of the Society, and mentioned the value of the I.E.S. Code of Practice. He referred to the problems which arose with the application of new lighting developments and to the need for co-operation between the architect, the designer, and the lighting engineer.

The response was made by Mr. Phillip Hartill, chairman of the Birmingham Centre,

who agreed with Mr. Caddell that co-operation was needed to ensure satisfactory treatment of the lighting problem. He hoped that the Stoke Group would realise their ambition in establishing an independent Centre. Mr. F. Jamieson, chairman of the Leicester Centre, replied to the toast to the visitors which was proposed by Mr. R. F. Squire, vice-chairman of the Stoke-on-Trent Group.

The chairman of the Group, Mr. T. Lockett, presided.

Forthcoming I.E.S. Meetings

LONDON

April 11th
Sessional Meeting. Mr. E. S. Calvert on "Aerodrome Lighting." (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m.

CENTRES AND GROUPS

April 4th
Mr. C. Campbell on "Light and Crime Detection." (At the Lecture Theatre of the Merseyside and North Wales Electricity Board's Showroom, Whitechapel, Liverpool 1.) 6 p.m.

April 5th
Annual General Meeting, to be followed by a paper by a local member. (At the Minor Durant Hall, Oxford Street, Newcastle-on-Tyne.) 6.15 p.m.

April 12th
Mr. J. D. Callaway on "Lighting of Steelworks." (At the Y.M.C.A., Swansea.) 6 p.m.

April 13th
Mr. J. D. Callaway on "Lighting of Steelworks." (At the South Wales Electricity Board Demonstration Theatre, The Hayes, Cardiff.) 5.45 p.m.

April 13th
Mr. W. A. R. Stoyle on "Maintenance of Fluorescent Lamps and Auxiliary Gear." (Joint Meeting with the Association of Supervising Engineers.) (At the Reynolds Hall of the Manchester College of Technology, Sackville Street, Manchester.) 6 p.m.

April 14th
Mr. S. A. Wood on "Interior Decoration and its Influence on Illumination." (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

April 14th
Mr. A. L. Randall on "Electric Lamps: Yesterday, Today and Tomorrow." (At the Yorkshire Electricity Board, 45/53, Sunridge Road, Bradford.) 7.30 p.m.

April 17th
Annual General Meeting, followed by Presidential Address, by Dr. J. N. Aldington. (At the Lighting Service Bureau, 24, Aire Street, Leeds, 1.) 6 p.m.

April 20th
Mr. H. R. Ruff on "Black Light and its Applications." (At the Demonstration Theatre, East Midlands Electricity Board, Leicester Sub-Area, Charles Street, Leicester.) 6.30 p.m.

April 21st
Presidential Address, by Dr. J. N. Aldington, and Luncheon. (At the Grand Hotel, Bristol.)

April 24th
Annual General Meeting. (At the Medical Library, The University, Western Bank, Sheffield, 10.) 6 p.m.

April 28th
Annual General Meeting, followed by a Film Show. (At the Electricity Showrooms, Market Street, Huddersfield.) 7.15 p.m.

May 2nd
Annual General Meeting, followed by a "Brains Trust." (At the Lecture Theatre of the Merseyside and North Wales Electricity Board's Showroom, Whitechapel, Liverpool, 1.) 6 p.m.

May 25th
Annual General Meeting and Film Evening. (At the Demonstration Theatre, East Midlands Electricity Board, Charles Street, Leicester.) 6.30 p.m.

May 16th-19th
Summer Meeting at Buxton.

SITUATION WANTED

CORPORATE MEMBER (I.E.S), 23, seeks change of employment, with good prospects. Fully conversant with planning of industrial and commercial lighting schemes.—Box No. D.

SITUATIONS VACANT

A vacancy occurs on the London staff of Crompton Parkinson Limited for a CHIEF STREET LIGHTING ENGINEER. The successful applicant will be required to organise and direct the activities of the Street Lighting Department, including fittings, design and sales, and the Technical Advisory Service. Salary in accordance with experience and qualifications. Applications, under confidential cover, to the General Sales Manager, Supplies Division, Crompton House, Aldwych, W.C.2.

DRAUGHTSMAN with works and electrical experience required for detail and design drawings in connection with lighting fittings for both fluorescent and tungsten lamps. Applications, in writing, should be sent to the Chief Illuminating Engineer, Ekco-Ensign Electric, Ltd., 5, Vigo Street, London, W.1.

CORPORATION OF GREENOCK
PUBLIC LIGHTING ASSISTANT

THE CORPORATION OF GREENOCK invite applications for the position of Public Lighting Assistant on the salary grade A.P.T. IV (£480 rising to £525 per annum). Applicants must have had extensive practical experience of all forms of street and tenement stair lighting and have considerable administrative experience and be capable of assuming control of the Public Lighting Department of the Corporation under the superior direction of the Burgh Surveyor and Master of Works. The appointment will be subject to termination on one month's notice on either side and the position is designated under the Local Government Superannuation (Scotland) Act, 1937. Applications stating age, qualifications and full details of experience, accompanied by copies of three recent testimonials, should be lodged with the undersigned on or before the 31st day of March, 1950. Canvassing directly or indirectly will be a disqualification.

Municipal Buildings, Greenock. A. GRAY, *Town Clerk.*

POSTSCRIPT

By "Lumeritas"

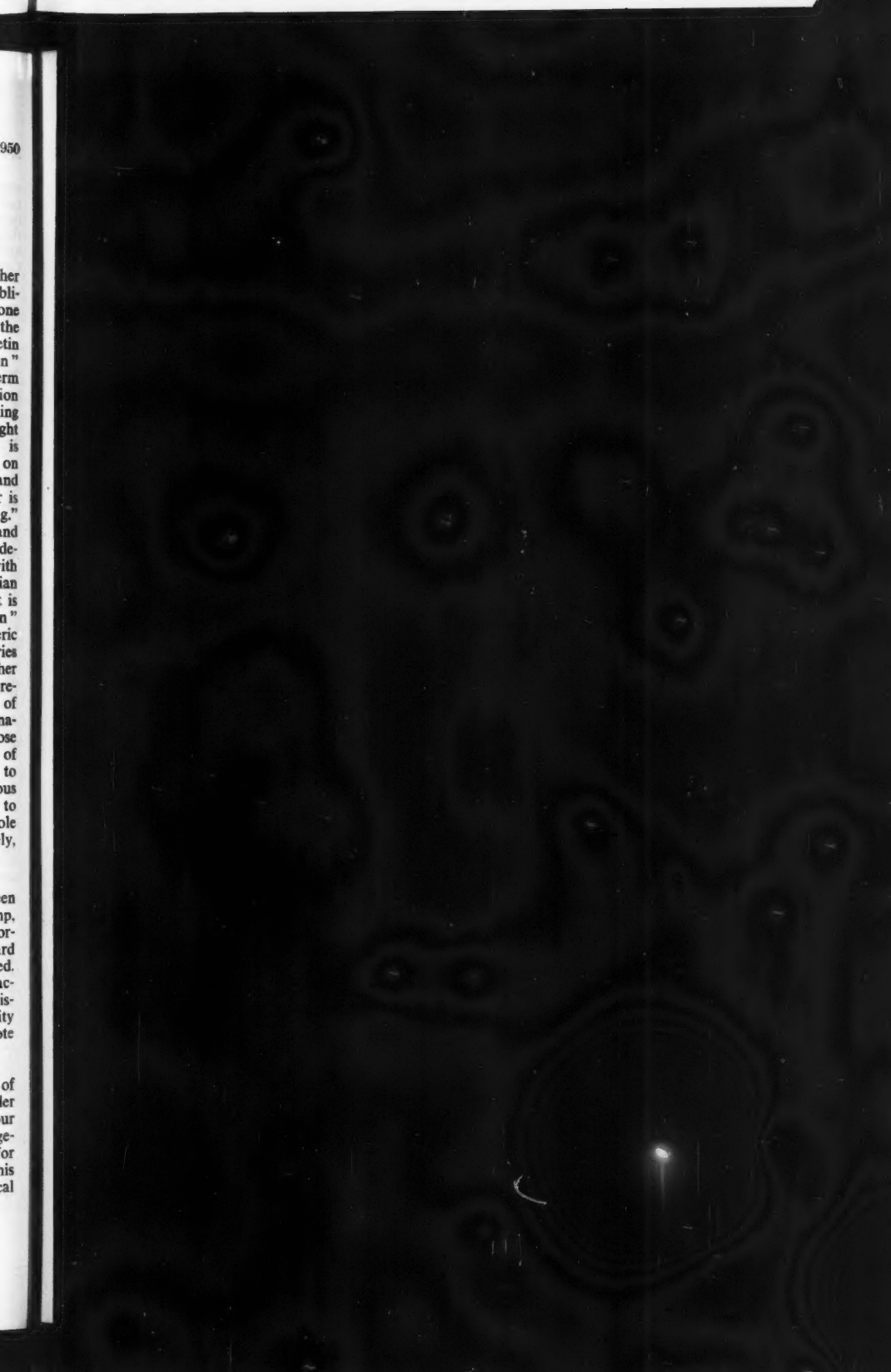
Among the queer allegations against fluorescent lighting is that it causes baldness! In the popular illustrated weekly, "Picture Post," I noticed recently a letter from a reader asking if there is any truth in this statement, and I was pleased to note the sensible editorial reply to the effect that fluorescent radiations are no more likely to cause baldness than are solar radiations. A fortnight later another correspondent took up the theme in the following "Light Verse," which I quote with acknowledgements to "Picture Post,"—

"The office boss
Is at a loss
To know what thins his hair.
He blames the fluorescence
We now see everywhere.
I'm wondering if it could be
Because, in sercet—stealthily
His hair was thinning, but UNlit
The poor bloke never noticed it?
Beauty lies . . . (ah, how it lies!)
Its dwelling—in beholders' eyes.
Fine art conceals a damaged pride.
Strong light reveals—what's best to hide.
So—I advise each 'cootsome' knight
To court the kindly candle-light."

I understand that this particular "score" is not a new one but made its first appearance during the war. What next, I wonder?

In another illustrated paper—this time a daily—a reader's letter reported his find of an old carbon filament lamp in a cellar in Manchester in 1936. For curiosity he took it home and found that it worked. When he moved south the lamp went with him and has been in constant use in the porch of his house ever since. He believes it is about 40 years old, and although it is getting a little dim it continues to "peg away." Is this a record?

The Australian Department of Labour and National Service is to be congratulated upon the preparation of a series of publications dealing with artificial lighting in the printing industry. The series comprises a bulletin dealing with factors affecting seeing, methods of lighting, "quality of illumination," light-sources for colour printing, colour for printing industry interiors, maintenance of lighting, and recommended values of illumination, together with five sets of data sheets. All the publications are well illustrated with half-tone blocks and line drawings. I notice in the glossary of terms at the end of the bulletin the statement that the term "illumination" is often used synonymously with the term "lighting," but specifically, "illumination is used to designate visible radiation falling on a surface as distinguished from light emitted from a source." This usage is exemplified earlier in the bulletin, for on one page occurs the phrase "quality and quantity of illumination" and on another is found "quantity and quality of lighting." The practice of using "illumination" and "lighting" as if they are synonyms is widespread, and I do not mention it here with any intention of criticising our Australian friends in particular. Surely, however, it is confusing to use the term "illumination" with reference to a particular photomteric quantity as well as to denote that congeries of photometric quantities and other "factors" involved in "lighting"? Moreover, while the expression "quality of lighting" can have reference to a combination of components, as is intended by those who use it, the expression "quality of illumination" is equivalent, technically, to "quality of surface density of luminous flux," and if this means anything it seems to me to have reference only to the sole qualitative characteristic of light—namely, that which determines its "colour."

Although a good deal of thought has been given to the design of the study lamp, and it is the only form of table or floor-stand lamp covered by a British Standard specification, it appears to be rarely used. Is it price, size, appearance, or manufacturers' inertia that is restricting the dissemination of these units? It seems a pity that more effort is not made to promote their use.

The apparently growing frequency of brutal assaults upon wayfarers is a reminder for us that better lighting of some of our streets is still required for the discouragement of thuggery. Recently, demands for the improvement of street lighting on this account have been made to several local authorities.